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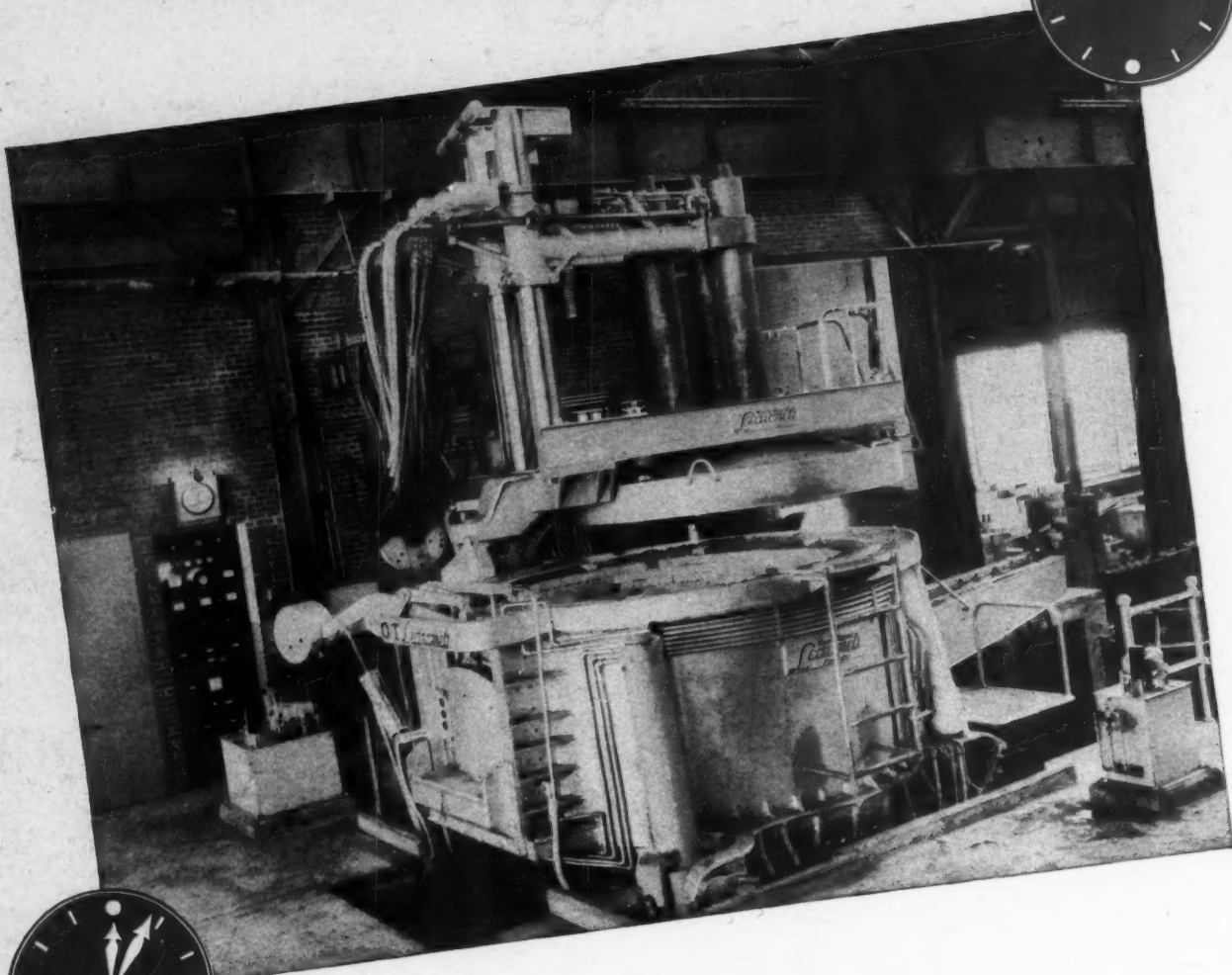
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★ THE FOUNDRYMEN'S OWN MAGAZINE

# American foundryman



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January 1947



# American Foundryman

Official publication of American Foundrymen's Association

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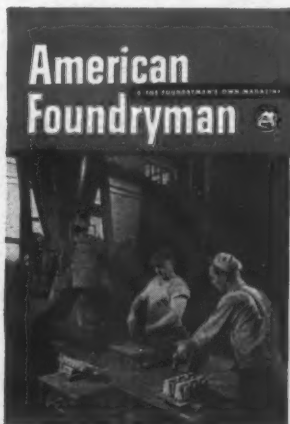
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The American Foundrymen's Association is not responsible for statements or opinions advanced by authors of papers printed in its publication.

### This Month's Cover

Modern core making practice. Operator blowing cores with duplicate equipment to achieve maximum productivity. One box has been stripped while second box is being cleaned preparatory to blowing.

Photo courtesy Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

Published monthly by the American Foundrymen's Association, Inc., 222 W. Adams St., Chicago 6. Subscription price, to members, \$4.00 per year; to non-members, \$6.00 per year. Single copies, 50c. Entered as second class matter July 22, 1938, under the Act of March 3, 1879, at the post office, Chicago, Illinois. Additional entry at Omaha, Neb.



# JANUARY WHO'S WHO



**C. E. Westover**

Was general manager, W & L Foundry Co., Inc., Norfolk, Neb., during the period 1918-22 . . . From 1923-25 was foundry manager, Omaha Steel Works, Omaha, Neb. . . . During 1926 was associated with American Manganese Steel Division, American Brake Shoe Co., Denver, Colo., as plant manager . . . Appointed foundry superintendent, Otis Elevator Co., Buffalo, N. Y. (1927-29) . . . Assumed a similar position with Farrell-Cheek Steel Co., Sandusky, Ohio, 1930-34 . . . The following year (1935) became general superintendent, Burnside Steel Foundry Co., Chicago . . . July, 1941, Mr. Westover assumed the post of Executive Vice-President, American Foundrymen's Association, Chicago . . . Resigning his position in 1943, the author organized his own firm, Westover Engineers, Milwaukee . . . A member of A.F.A.

In this issue, Mr. Westover presents a discussion on *Foundry Costs, Reduction and Control* . . . Born in Lincoln, Neb. . . . A graduate of the state university in 1908 . . . Founded the Westover Foundry Co., Lincoln (1914-17) . . .

Automatic Machine Co., Cleveland . . . Was appointed pattern shop foreman for Allyne-Ryan Foundry Co., Cleveland . . . At present is technical patternmaker, Cleveland Trade School, Cleveland . . . Has been active in the A.F.A. patternmaking division for many years and was 1945-46 division chairman . . . Has written numerous articles for the trade press and for vocational magazines . . . Is well known for his A.F.A. convention papers on patternmaking and allied subjects . . . Member of A.F.A. . . . Article contributed is *Variety Found in 1946 A.F.A. Apprentice Contest Patterns*.

Author of *Molding Sand, Brass and Bronze*, Lane B. Osborn was born in Evansville, Ind. . . . A graduate of the University of Illinois, Urbana, he entered the castings industry affiliated with the Studebaker Corp., South Bend, Ind. . . . In 1928 became associated with the Graham-Paige Motor Corp., Detroit and Evansville . . . A year later the author joined his present company, Houghland & Hardy, Inc., Evansville . . . A member of A.F.A., he has served on various A.F.A. sand committees.



**L. B. Osborn**

Author, E. H. Schleede, has spoken before a number of A.F.A. chapters on cement patternmaking and this issue contains his paper, *Gypsum Cement—Practical Patternmaking Applications* . . . Schooled in Chicago, he attended night classes at Lewis Institute . . . As patternmaker, in 1914, he was connected with R. Williamson & Co., Chicago . . . From 1920-25 was affiliated with Cole Mfg. Co., Chicago, as patternmaking foreman . . . Associated with Art Metal Construction Co., Jamestown, N. Y., he was sales engineer (1925-30) . . . Owned his own business in Chicago, 1931-39, and was manager of a bronze foundry in Chicago until 1942 . . . Has been with U. S. Gypsum Co., Chicago, for the past years as sales engineer . . . Has written for the trade press. An A.F.A. member.



**C. A. Brashares**

Affiliated with Harbison-Walker Refractories Co. for eighteen years has afforded C. A. Brashares ample time to study *Foundry Refractories, Properties and Application*, which can be found in this issue . . . A native of Lancaster, Ohio . . . Case School of Applied Science, Cleveland, is his alma mater, receiving his Bachelor of Science degree in chemical engineering (1928) . . . Began his affiliation with Harbison-Walker in Pittsburgh as a member of the research department . . . In 1935 was appointed to the technical sales department . . . Two years later (1937) was transferred to Charlotte, N. C. . . . Returned to Pittsburgh in 1941 . . . His findings have been published by the trade press and include developments in refractories . . . Member of American Ceramic Society.



**E. H. Schleede**

The author, E. H. Schleede, has spoken before a number of A.F.A. chapters on cement patternmaking and this issue contains his paper, *Gypsum Cement—Practical Patternmaking Applications* . . . Schooled in Chicago, he attended night classes at Lewis Institute . . . As patternmaker, in 1914, he was connected with R. Williamson & Co., Chicago . . . From 1920-25 was affiliated with Cole Mfg. Co., Chicago, as patternmaking foreman . . . Associated with Art Metal Construction Co., Jamestown, N. Y., he was sales engineer (1925-30) . . . Owned his own business in Chicago, 1931-39, and was manager of a bronze foundry in Chicago until 1942 . . . Has been with U. S. Gypsum Co., Chicago, for the past years as sales engineer . . . Has written for the trade press. An A.F.A. member.

See, in this issue, Mr. Cech's paper which summarizes the 1946 A.F.A. National Apprentice Contest—Patternmaking Division . . . The author was born in Vienna, Austria . . . Obtained his education in American schools and colleges . . . Began his patternmaking career in Cleveland with American Steel & Wire Co., Cuyahoga Works . . . Was placed in a similar position with Wellman, Searer & Morgan Engineering Co. and Corrigan McKinney Steel Co., both of Cleveland . . . Became pattern checker and assistant foreman while affiliated with Cleveland



**F. C. Cech**

## DETROIT IN '47

See convention story on pages 22 and 23 for tentative technical sessions and Detroit chapter convention committee personnel.



## MEN, METHODS AND MATERIALS

THE FOUNDRY INDUSTRY builds with Materials, Knowledge and Men.

To produce better castings, foundries require better materials, better equipment. They have need of new and more efficient equipment to improve quality and increase productivity, and to better working conditions. Foundries can be cleaner, more properly ventilated; and will, of course, provide the best type of wash- and locker-rooms. Excellent working conditions attract better workmen, promote their best efforts, and result in higher quality products. It is sometimes possible to produce good castings with poor materials and inferior equipment, but that practice is extremely exceptional.

As castings users become more exacting, knowledge and skill become increasingly important factors in competition. The foundry producing castings that require little or no machining, that have superior appearance and uniformly good physical properties, will always have a choice of customers, however. The threat that other products will replace castings need never materialize if casting quality is maintained at the level of consumer demand. Technical "know-how," unceasing striving for better quality, greater productivity, will keep the nation's foundries—representatives of one of the world's oldest, most progressive industries—basic to all other industries. But only by making the most of all pure and process research and all practical developments can foundries remain progressive.

Neither Materials nor Knowledge can function, however, unless Men put them to work. Foundries

must examine their industrial souls, then, to see if all has been done that can be done to attract promising men and to retain those doing a good job. That THE FOUNDRY IS A GOOD PLACE TO WORK, that it will steadily become a better workplace and a wider career field for the graduates of our high schools, vocational and engineering schools, should be emphasized unceasingly to young men, their parents and their teachers. Foundries cannot sit back and wait for promising men to overrun their employment offices; it is necessary, then, that they encourage high school, vocational school and engineering school training of the foundrymen of the future.

The American Foundrymen's Association is a medium any foundry or foundryman can employ to keep in contact with the best in Materials, Knowledge and Men. It is, however, more than a source of information and help; it enables active participation in the constant development of the techniques, practices and processes of the industry.

There can be no standing still in the foundry industry; foundries and foundrymen either advance or end up on the slag heap.

H. A. DEANE, National Director

AMERICAN FOUNDRYMEN'S ASSOCIATION

*HORACE A. DEANE, vice-president in charge of operations, American Brake Shoe Co., Brake Shoe and Castings Div., New York, is a National Director of the American Foundrymen's Association. Born in Illinois he attended the state university, graduating in 1926. Affiliated with Deere & Co., Moline, Ill., after graduation, he joined his present firm in 1939. Appointed assistant works manager (1939) he was named works manager four years later. Last year he was appointed to his present position. Mr. Deane has served as Chairman of both the Quad-City and Metropolitan chapters.*



*The Horace H. Rackham Educational Memorial (front view, from Farnsworth Avenue), where the first sessions of the 1947 A.F.A. Convention will be held. Located in the heart of Detroit's noted art center, the modern edifice was dedicated in 1942 and provides excellent meeting facilities.*

## DIVISIONS OUTLINE DETROIT PROGRAMS

PLANS FOR THE 51st Annual A.F.A. Convention, to be held in Detroit April 28-May 1, are being made with full consideration for the vital job assigned to the post-war foundry industry. Today, castings are needed by most every manufacturer producing consumer goods and the production of good castings will be the keynote of all sessions.

### Program

Adjoining this article is a tentative schedule of convention sessions which, while subject to change, indicates a full program of meetings for each of the A.F.A. divisions. Included also are the special events which will be open, and of interest to all.

As previously announced, dual registration facilities will be set up at both the Statler and Book-Cadillac hotels, which means that both hotels may be designated as "A.F.A. Headquarters." Technical sessions will be divided in the main between these two hotels.

However, all the technical sessions of Monday, April 28, from 10 am to 5:30 pm, inclusive, are scheduled at the Rackham Educational Memorial. This beautiful building, where Detroit A.F.A. chapter meets, provides excellent meeting-room accommodations and is the headquarters of the Detroit Engineering Society.

Featuring Opening Day, April 28, will be a general meeting in the main auditorium at Rackham Memorial, to be addressed by a prominent speaker, probably on the relationship between the casting industry and the Detroit automotive industry. While the speaker has not yet been announced, this will be a session that all visitors should plan to attend.

As in previous years, a special dinner has been arranged for visiting Chapter Officers and Directors, to be served at 7 pm Tuesday, April 29. A special program is being arranged for this year's dinner with a guest speaker on the subject of organizational work. This event, hitherto held on a purely informal basis, will be a highlight of the 1947 Convention for Chapter Officers and Directors.

Another traditional event will be the holding of a Canadian Luncheon on Wednesday, April 30, for members of A.F.A. from across the border. Always a popular gathering, it is expected that the Canadian Luncheon will be especially well attended in Detroit.

### Annual Business Meeting

The Annual Business Meeting of the Association will take place Wednesday afternoon, April 30, and no other convention sessions are scheduled at that time. All present at the convention are invited to participate in the election of new Officers and Directors of A.F.A., with-

ness the presentation of A.F.A. Annual Apprentice Contest prizes to the winners, and hear an outstanding lecture.

As announced in the December issue of *AMERICAN FOUNDRYMAN*, the Annual Lecture will henceforth be known as, the Charles Edgar Hoyt Annual Lecture, in honor of C. E. Hoyt, for nearly 30 years the chief administrative officer of A.F.A. and Manager of Foundry Exhibits since 1906. Dr. James T. MacKenzie, chief metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., has been selected to present the 1947 lecture on "The Cupola Furnace" and an overflow attendance is anticipated.

### Annual Banquet

The A.F.A. Annual Banquet will be served at 7 pm on Thursday, May 1, the last day of the convention proper, and, as in previous years, an outstanding national speaker will deliver the main address. A further announcement in regard to the banquet will be forthcoming in the near future, and will include information on advance reservations for the banquet.

To conserve the time of foundrymen, the convention program again has been arranged so as to bring all the sessions on one subject within a minimum of days. Thus, the three technical sessions and round-table luncheon of the Aluminum and Magnesium Division of A.F.A. will all be held on April 28 and 29. Brass and Bronze Division sessions are scheduled for April 29 and 30. Meetings of the Educational Division will be completed April 28.

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The Malleable Iron Division has tentatively arranged its program for two technical sessions on April 28 and a round-table luncheon on April 29. Likewise, the Steel Division probably will hold all its meetings on April 30 and May 1. The Pattern-making Division sessions, however, are scheduled on April 29 and May 1.

#### General Sessions

Meetings of various general interest committees have thus far been

arranged as follows: *Cost* committee, May 1; *Inspection* committee, April 29; *Refractories* committee, April 29; *Plant and Plant Equipment* committee, April 30; *Job Evaluation and Time Study* committee, May 1; *Heat Transfer* committee, April 29. A full Gray Iron Division program includes technical sessions on April 29, 30, and May 1. In addition, a four-session Gray Iron Shop Course is being arranged, with one session on each of the four convention days, all for the afternoon

or evening. It is expected that the shop course will be well attended, as in the past years, and at least two sessions are scheduled as evening meetings for the convenience of local plant men.

#### Sand Meetings

The new Sand Division of A.F.A. is planning on technical sessions April 29 and 30, largely dealing with sand research problems. In addition, the Sand Shop Course will

(Continued on Page 89)

## TENTATIVE SCHEDULE OF SESSIONS

**Detroit—April 28-May 1, 1947**

### 51st ANNUAL A.F.A. CONVENTION

(NOTE: Sessions on Monday, April 28, 10:00 am—5:30 pm, inclusive, to be held at Rackham Educational Memorial. All other sessions, including Monday evening, to be held at Statler or Book-Cadillac Hotels.)

#### Monday, April 28

- 8:30 am—Registration begins.
- 10:00 am (a) Aluminum and Magnesium Session.  
(b) Educational Div. Business Meeting.  
(c) Malleable Session.
- 12:00 Noon Luncheon
- 2:00 pm—General Meeting
- 4:00 pm (a) Aluminum and Magnesium Session.  
(b) Educational Session.  
(c) Malleable Session.  
(d) Gray Iron Shop Course (1).
- 7:00 pm—Educational Dinner and Session.
- 8:00 pm (a) Sand Shop Course (1)—Malleable Iron.  
(b) Aluminum and Magnesium Div. Business Meeting.

#### Tuesday, April 29

- 10:00 am (a) Aluminum and Magnesium Session.  
(b) Brass and Bronze Session.  
(c) Malleable Session.  
(d) Heat Transfer Session.
- 12:00 Noon (a) Aluminum and Magnesium Round Table Luncheon.  
(b) Malleable Round Table Luncheon.  
(c) Pattern Div. Luncheon and Business Meeting.
- 2:00 pm (a) Brass and Bronze Session.  
(b) Gray Iron Session.  
(c) Malleable Div. Business Meeting.  
(d) Sand Research Session.
- 4:00 pm (a) Sand Div. Business Meeting.  
(b) Patternmaking Session.  
(c) Refractories Session.
- 7:00 pm—Chapter Officers and Directors Dinner.

- 8:00 pm (a) Sand Shop Course (2)—Non-Ferrous.  
(b) Gray Iron Shop Course (2).  
(c) Inspection of Castings.

#### Wednesday, April 30

- 10:00 am (a) Gray Iron Session.  
(b) Steel Session.  
(c) Sand Research Session.
- 12:00 Noon (a) Canadian Luncheon  
(b) Brass and Bronze Round Table Luncheon.
- 2:00 pm—Annual Business Meeting and Charles Edgar Hoyt Annual Lecture
- 7:00 pm—A.F.A. Alumni Dinner  
(by invitation only)
- 8:00 pm (a) Steel Div. Business Meeting.  
(b) Brass and Bronze Div. Business Meeting.  
(c) Sand Shop Course (3)—Steel.  
(d) Gray Iron Shop Course (3).  
(e) Plant and Plant Equipment Session.

#### Thursday, May 1

- 8:30 am—Cost Committee Breakfast
- 10:00 am (a) Gray Iron Session.  
(b) Steel Session.  
(c) Job Evaluation and Time Study Session.
- 12:00 Noon (a) Steel Round Table Luncheon.  
(b) Pattern Round Table Luncheon.
- 2:00 pm (a) Foundry Cost Session.  
(b) Gray Iron Session.  
(c) Gray Iron Shop Course (4).
- 4:00 pm (a) Steel Session.  
(b) Sand Shop Course (4)—Gray Iron.  
(c) Gray Iron Div. Business Meeting.
- 7:00 pm—Annual A.F.A. Banquet.

# UNSOUNDNESS IN CAST LIGHT ALLOYS

Part I of an A.F.A. committee report. The second and concluding installment will appear in the February issue.

A.F.A.  
Aluminum and Magnesium  
Division  
Subcommittee on  
Shrinkage and Porosity

MANY INVESTIGATIONS AND opinions have been published regarding the occurrence of unsoundness in aluminum and magnesium alloy castings. As with other alloys, many types of unsoundness in light-alloy castings are possible, but this paper will deal mainly with unsoundness which arises (1) from shrinkage, (2) from the gas evolved from the melt when it solidifies, or

(3) from the combined effects of both.

Gas holes resulting from the mechanical entrapment of mold gases in the casting or defects from dross, which is actually a mixture of melt, oxide, gas, or air, and the many other types of defects leading to voids in the casting will only be mentioned.

Furthermore, the unsoundness in the light-alloy castings, as discussed in this paper, will be confined to castings produced by either the sand-cast method or permanent-mold method, but not by the die-cast method.

An extensive literature review

does not appear to be necessary. It is sufficient to point out that there is considerable confusion among foundrymen, metallurgists, inspectors, etc., who have occasion to deal with the problem of defects arising from dissolved gases and from shrinkage in light-alloy castings.

However, if several scores of such individuals were discussing the problem together, and if all used the same terms of the same meaning, the chances are reasonably good that for the most part they would find themselves substantially in agreement on the general subject of unsoundness arising from gas evolution and shrinkage in light-alloy castings.

One of the factors leading to a confusion of terms, and consequently to differences of opinion, is the fact that in both magnesium and aluminum alloys unsoundness arising from gas evolution and from shrinkage are closely related. Furthermore, there are all gradations between localized shrinkage on the one hand, and microporosity on the other.

In aluminum alloys there are also all gradations between gas porosity (pinhole porosity) and microporos-

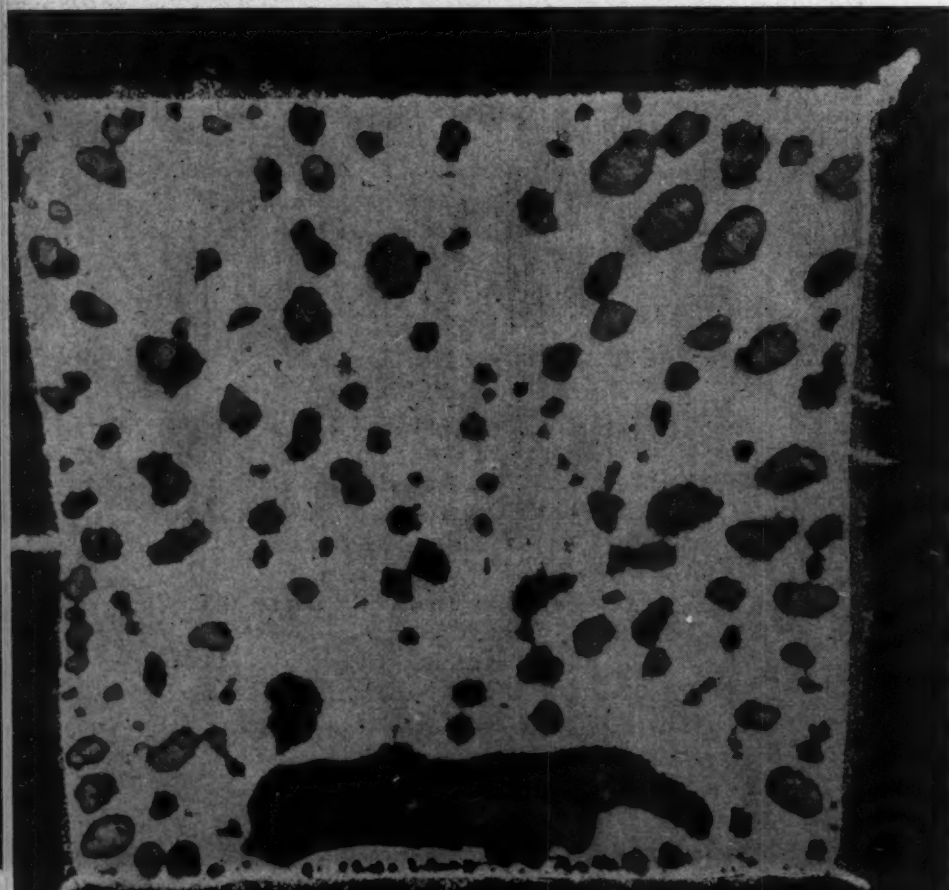


Fig. 1—Section of a 4-in. cube, no riser, poured from an ASTM-AZ-63 alloy melt which had been severely gassed with  $\text{CaH}_2$ . The large cavities formed by the hydrogen precipitated when the melt solidified are ample evidence of the considerable hydrogen solubility in magnesium melts. These "gas holes," which may be much finer where solidification is more rapid, correspond to pinholes having a similar origin in aluminum-base castings.  $\times 1$ .

AMERICAN FOUNDRYMAN

A report prepared by J. C. DeHaven, Battelle Memorial Institute, Chairman; Walter Bonsack, National Smelting Co.; L. W. Eastwood, Battelle Memorial Institute; R. F. Hauser, Eclipse-Pioneer Div. of Bendix Aviation Corp.; C. E. Nelson, The Dow Chemical Co.; and W. E. Sicha, Aluminum Co. of America, members of the Subcommittee on Shrinkage and Porosity, Aluminum and Magnesium Division of the American Foundrymen's Association. The illustrations for the report were supplied by the Aluminum Co. of America, The National Smelting Co., The Dow Chemical Co., and Battelle Memorial Institute. The text of the report was prepared by L. W. Eastwood, and reviewed by the Committee.

ity. The primary purpose of this paper then will be to supply additional, and possibly clarifying, information on the following points:

1. Relationship of shrinkage to microporosity, and the gradation of one into the other.

2. Relationship of gas porosity to microporosity, and the gradation of one into the other.

3. Causes of the various types of unsoundness, and the effects of several important factors on the form of the defects.

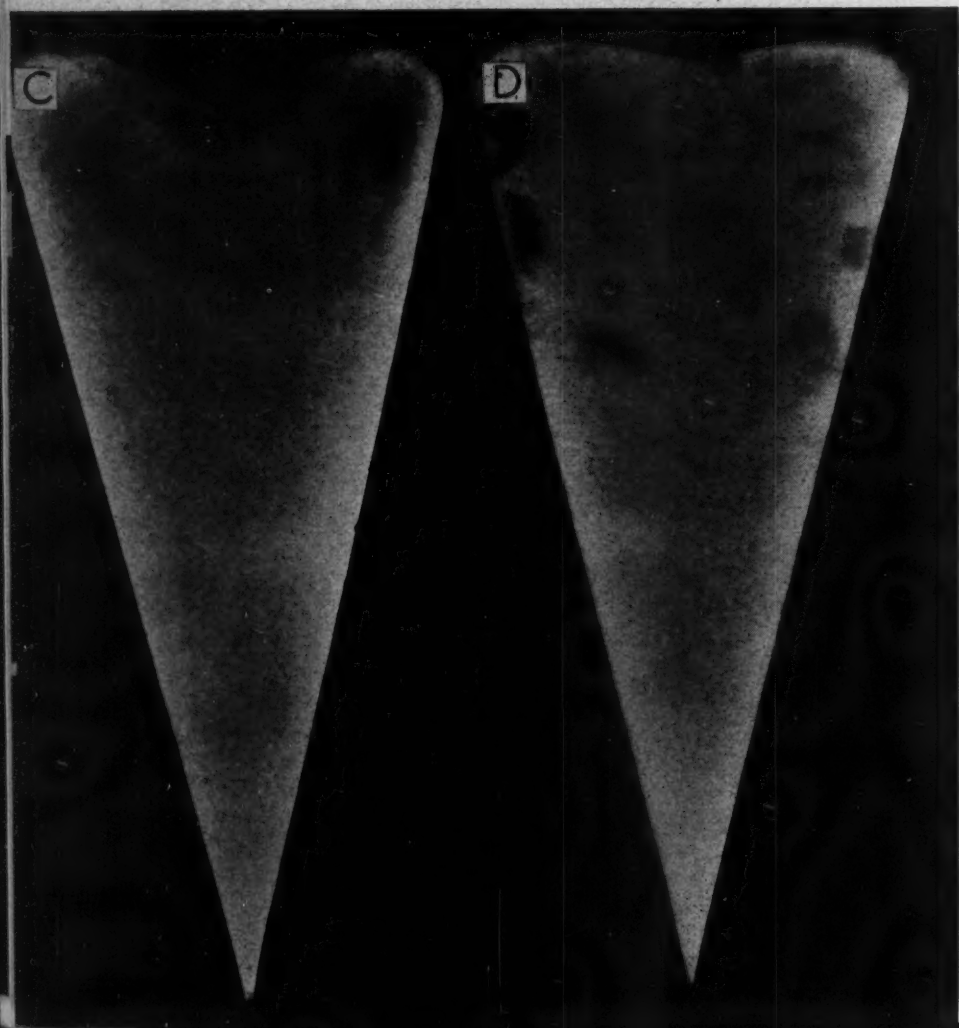
4. Terms employed to describe the defects, some of which have already been mentioned in this paper.

5. A correlation of the appearance of defects as viewed on the as-cast or machined surface and by radiography.

Fig. 2—(right above) Machined vertical sections of degassed metal cast in dry sand. A—99 per cent Al. B—No. A-132 alloy containing 0.8 per cent Cu, 0.8 per cent Fe, 12 per cent Si, 1 per cent Mg, and 2.5 per cent Ni.  $\times 5/6$ .

Fig. 3—(right) Machined vertical sections of degassed metal cast in dry sand. C—No. 214 alloy containing 3.8 per cent Mg. D—No. 122 alloy containing 10 per cent Cu, 1.2 per cent Fe, and 0.2 per cent Mg.  $\times 5/6$ .





Consideration will be given to the general relationship of the various types of unsoundness, and specific examples of unsoundness will be shown to illustrate the general principles.

Having specifically indicated the purpose of the paper, it will be well to point out here that no attempt is made to evaluate the importance of these defects on the properties or the serviceability of the castings containing them.

No formal attempt will be made to prepare a complete classification of terms. Instead, to the various forms of unsoundness, terms will be applied which are recommended (1) because they describe the cause of the defect and its appearance, or (2) if this is not possible, a term will be used which describes the defect but does not suggest an erroneous explanation of the cause of the defect.

In order to reduce the number of illustrations, reference will be made to photographs in other A.F.A. papers.

#### General Features of Unsoundness Caused by Shrinkage and Gas Evolution

**Shrinkage.** It is well known that when a liquid melt changes to a solid a contraction in volume occurs, which normally amounts to 4 to 6 per cent of the total volume of light-alloy melts, and this contraction will result in certain types of unsoundness known as shrinkage unless the casting is fed properly. The proper feeding involves the entire problem of proper casting design, pattern design, and the gating, risering, and chilling methods employed. The amount, shape, and distribution of this defect, known as shrinkage, will depend upon a number of factors. The main factors are:

1. Composition of the melt; namely, its content of various elements and metallic impurities.
2. Gas content of the melt.

*Fig. 4—(left above) Same as Fig. 2, except that radiographs of vertical sections 1 in. thick are illustrated.  $\times 5/6$ .*

*Fig. 5—(left) Same as Fig. 3, except that radiographs of vertical sections 1 in. thick are illustrated.  $\times 5/6$ .*

3. Manner and rate of solidification, and the degree of the directional solidification, as dictated by pouring temperature, the casting design, gating method, section thickness, etc.

The effect of some of these factors will be illustrated later in the paper.

**Unsoundness Caused by Gas Evolution.** It is also well known that in the light alloys of aluminum and magnesium the main if not the only gas which causes trouble is hydrogen, and it produces unsoundness as a result of the decreased solubility of the hydrogen in the melt when it solidifies. As a result of this decreased solubility, the gas is evolved.

#### Hydrogen Solubility

While the maximum solubility of hydrogen in aluminum depends upon several factors, in general, only a maximum of 2 to 4 cc of hydrogen per 100 grams of metal are dissolved in the melt. At ordinary pressure, however, the equilibrium solubility of hydrogen in the solid aluminum, even near the solidus line, is almost zero.

As a result, practically all of the gas in solution in the aluminum melt is normally evolved during solidification. When this gas is evolved, it forms a defect in the casting known as pinhole porosity. This porosity may be round or angular, coarse or fine. There are all gradations of this type of gas porosity, from coarse, rounded holes on the one hand, through angular pinholes to very fine porosity known as microporosity on the other.

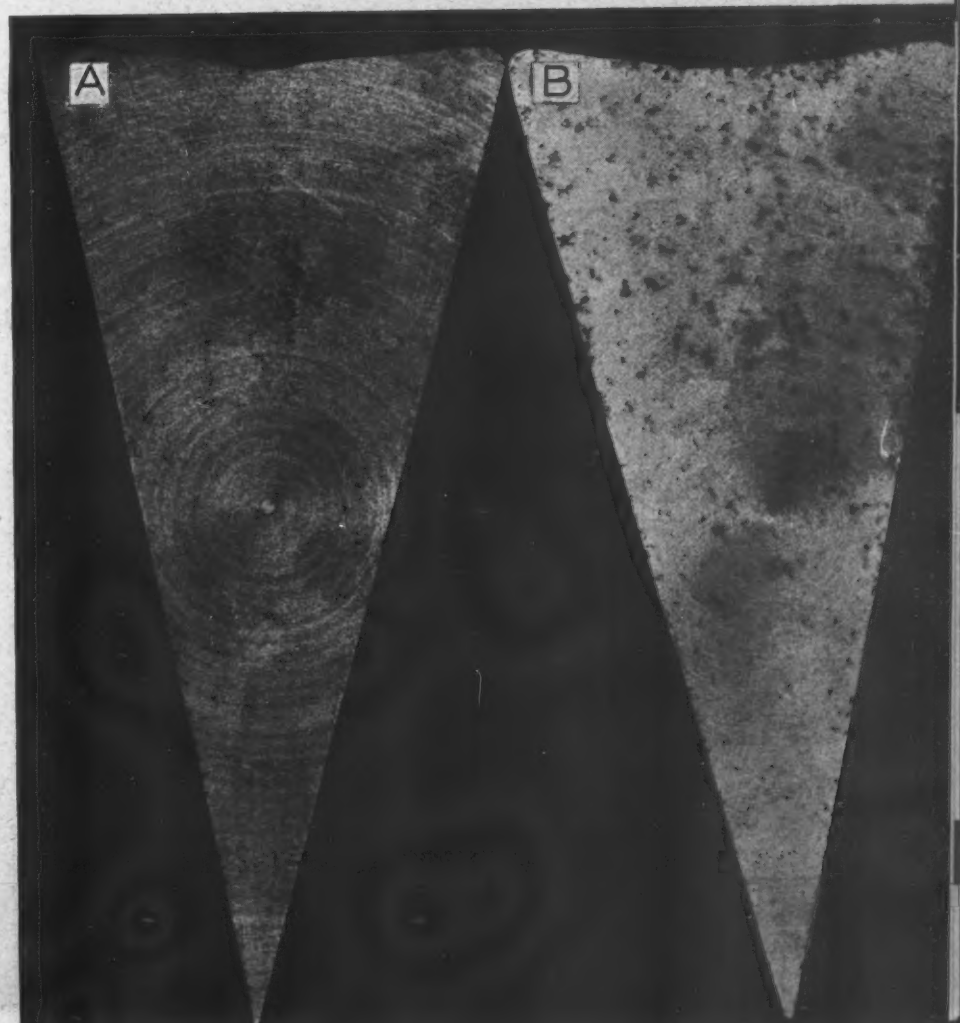
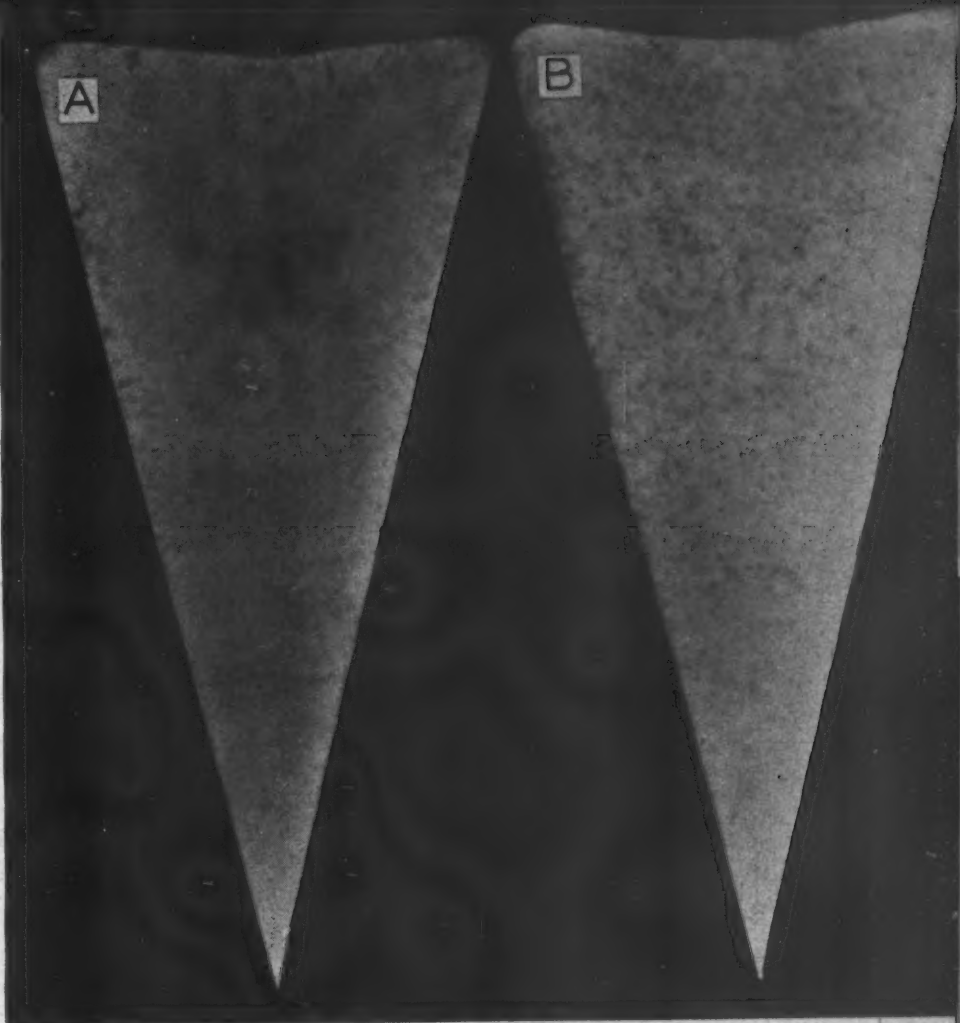
It cannot be overemphasized that pinhole porosity is caused only by the evolution of hydrogen from the aluminum-alloy melt when it solidifies. There are a number of factors which affect the amount, size, shape, and distribution of the pinholes.

However, this subject has been

*Fig. 6—(right above) Machined vertical sections of an aluminum-copper-silicon alloy. A—Poured after degassing by fluxing with chlorine. B—Poured before fluxing with chlorine.  $\times 5/6$ .*

*Fig. 7—(right) Same as Fig. 6, except that radiographs of vertical sections 1 in. thick are illustrated.  $\times 5/6$ .*

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considered in detail<sup>1</sup> and a further account of this problem need not be made here. It is sufficient to point out that the following factors are important in determining the amount, size, shape, and distribution of the unsoundness resulting from gas evolution in aluminum melts:

1. Alloy composition.
2. Gas content of the melt.
3. Grain size.
4. Solidification rate, degree of directional solidification, and manner of solidification as determined by casting design, gating practice, etc.

In contrast to aluminum casting alloys, magnesium alloys contain a maximum solid solubility near the solidus line of about 18 cc of hydrogen per 100 grams of metal, and this may increase to a maximum of 26 to 30 cc of hydrogen per 100 grams of melt in the temperature range 1200 to 1700 F.

When these high gas contents are encountered in the magnesium foundry, it is found that the risers swell, forming surfaces convex upwards, and that the casting contains large, rounded, or angular voids. They are quite similar to the pinholes in aluminum, but they are larger (perhaps 1/4-in. diameter or more) and, therefore, cannot be accurately called a pinhole. Instead, they may be called "gas holes."

An outstanding example<sup>3</sup> is illustrated by Fig. 1. Normally, however, such high gas contents are not encountered in magnesium foundry operations because (1) solid solubility of hydrogen in magnesium near the solidus line is high, and (2) the gas which is in the melt accentuates microporosity instead. Therefore, these large gas voids are not usually observed. However, they fit into the general over-all picture of the problem of unsoundness in light-alloy castings.

#### Unsoundness

As with the other types of unsoundness, the unsoundness resulting from gas in magnesium-alloy melts may manifest itself in quite a variety of defects. As later illustrated, all gradations of rounded or oblong gas holes through angular, slit-like gas holes to small interconnected angular pores referred to as microporosity may be observed. Again, the main factors which determine the amount, size, shape, and distribu-

tion of the voids resulting from the gas in magnesium melts are:

1. Alloy composition.
2. Gas content of the melt.
3. Solidification rate, the degree of directional solidification, and other factors affecting the manner of the solidification of the casting.

As illustrated later, in either aluminum or magnesium alloys the unsoundness may grade from highly localized shrinkage through various more generally distributed types of unsoundness referred to as "shrinkage of a spongy type" to microporosity.

Likewise, the unsoundness resulting from gas evolution will grade from pinholes in aluminum or gas holes in magnesium through various angular pores to fine angular porosity known as microporosity. Hence, both shrinkage and the gas content of the melts combine to determine the amount, size, shape, and distribution of microporosity in the castings. In addition, the gas evolved will influence the amount of localized shrinkage.

#### Factors Affecting Shrinkage Porosity

The various main factors affecting the amount, size, shape, and distribution of shrinkage defects have already been listed. These factors were alloy composition, gas content of the melt, and the manner of solidification of the casting.

*Effect of Alloy Composition.* The type of shrinkage with which most foundrymen are familiar is localized shrinkage. The most localized shrinkage consists of a surface set or cavity. The effect of composition on the type of localized shrinkage in aluminum castings is well illustrated by Figs. 2, 3, 4, and 5.

The test castings are wedges 6 in. high, 3 in. wide at the top, and 2 in. thick, and a vertical cross section at the mid-point of the casting is illustrated. These melts, degassed by chlorine fluxing, were poured into the top of the mold cavity in a dry sand mold without the use of a cope or pouring sprue and gate. The compositions of the alloys shown in Figs. 2, 3, 4, and 5 are:

A. Ninety-nine plus per cent Al.

B. No. 132, aluminum containing approximately 0.8 per cent Cu, 0.8 per cent Fe, 12.0 per cent Si, 1.0 per cent Mg, and 2.5 per cent Ni.

C. No. 214, aluminum containing

approximately 3.8 per cent Mg.

D. No. 122, aluminum containing approximately 10 per cent Cu, 1.2 per cent Fe, and 0.2 per cent Mg.

These four alloys illustrate quite well the effect of composition. Composition A is a substantially pure metal solidifying at constant temperature. Composition B is nearly 100 per cent eutectic which solidifies over a narrow range of temperature but not entirely at constant temperature. Composition C is a solid solution type solidifying over a considerable range in temperature, but no eutectic is formed. Composition D solidifies over a considerable range in temperature, but a large amount of eutectic with more intermetallic compound is formed.

#### Machined Surfaces

On the basis of the examination of Figs. 2, 3, 4, and 5, the first two of which are photographs of machined surfaces and the last two radiographs of the same specimens 1 in. thick, the following conclusions can be made:

1. With a pure metal solidifying at constant temperature, the shrinkage is highly localized; namely, it forms a surface set with a clean cavity with little or no surrounding spongy metal, as shown by Fig. 2 (composition A), and the radiograph, Fig. 4 (composition A).

2. When the alloy solidifies nearly but not entirely at constant temperature, such as composition B, the shrinkage again is highly localized in the form of a surface set and an internal cavity, but surrounding this cavity is a zone of spongy metal. Had composition B been 100 per cent eutectic, the unsoundness probably would approach in appearance that illustrated by composition A. The spongy area around the shrinkage cavity in composition B is well illustrated by the radiograph (Fig. 4) of this same specimen.

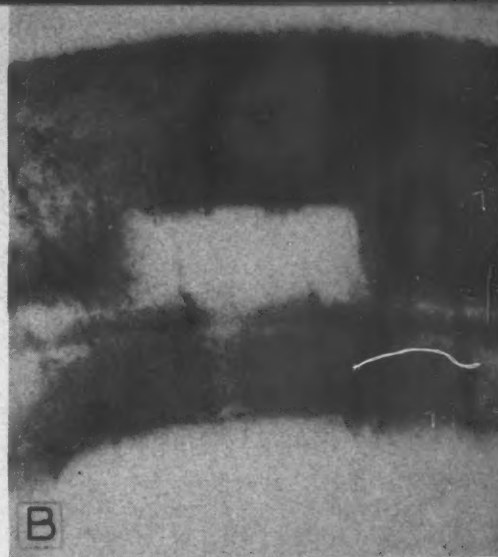
3. Composition D, which solidifies over a range in temperature with a considerable amount of eutectic solidifying at the end, shows a minor surface set; the shrinkage is not localized, but rather widely distributed, as indicated by the radiograph (Fig. 5, composition D). This localized shrinkage is not much in evidence on the machined surface (Fig. 3).

4. Composition C solidifies over a range in temperature without the

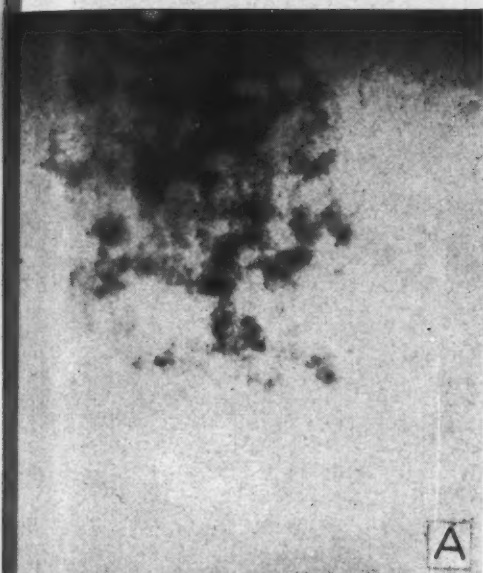


A

Fig. 8—(A) Radiograph showing shrinkage cavities in an inadequately fed 4-in. thick section of No. 220 alloy containing 10 per cent Mg. (B) Radiograph showing shrinkage cavities of a peculiar type in an inadequately fed  $\frac{1}{2}$ -in. thick section of No. 355 alloy containing 1.2 per cent Cu, 5 per cent Si, and 0.5 per cent Mg.  $\times 1$ .



B



A

Fig. 9—(A) Radiograph showing localized, spongy-type shrinkage in the upper portion of a 3 in. thick section of an inadequately fed, degassed No. 195 alloy. (B) Radiograph showing surface shrinkage of a fillet in an inadequately fed No. 195 alloy casting (see Fig. 10).  $\times 1$ .



B

formation of an eutectic, the surface set is relatively small, and there is no highly localized shrinkage. On the other hand, the entire top of the wedge is characterized by a considerable amount of spongy unsoundness. This porosity results largely from poor feeding of this portion of the casting. It is obvious that a difference of opinion can arise at this point. Some observers might call this defect "shrinkage of a general spongy type," the preferred description; others might call it microshrinkage, microporosity, etc, especially if the same defect was in a less obvious place in a commercial casting. This defect at the top of the wedge of composition C is well illustrated on the machined surfaces (Fig. 3), and is also well indicated by the dark portion of the radiograph (Fig. 5, composition C). Because the sections radiographed were 1 in. thick, the sensitivity is rather low, with the result that the unsoundness in the top of the wedge of composition C does not appear in

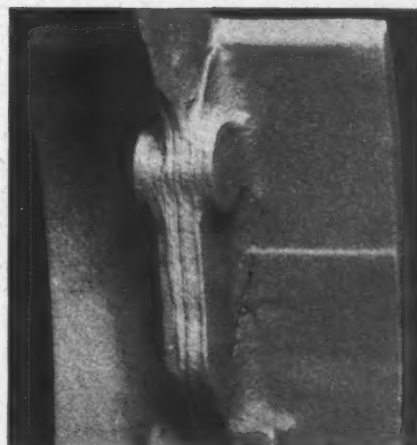


Fig. 10—Photograph of the same casting illustrated by radiograph (B) of Fig. 9.  $\times 1$ .

a high degree of contrast on the radiograph.

The important point to observe so far is that by pouring a similar casting from four different alloys a marked difference in the location, size, amount, and distribution of the shrinkage has been produced. While these illustrations are of aluminum-

base materials, similar effects could be shown for magnesium-base compositions. However, most commercial magnesium-base materials are of the same type as the aluminum-base compositions A and C.

#### Microporosity

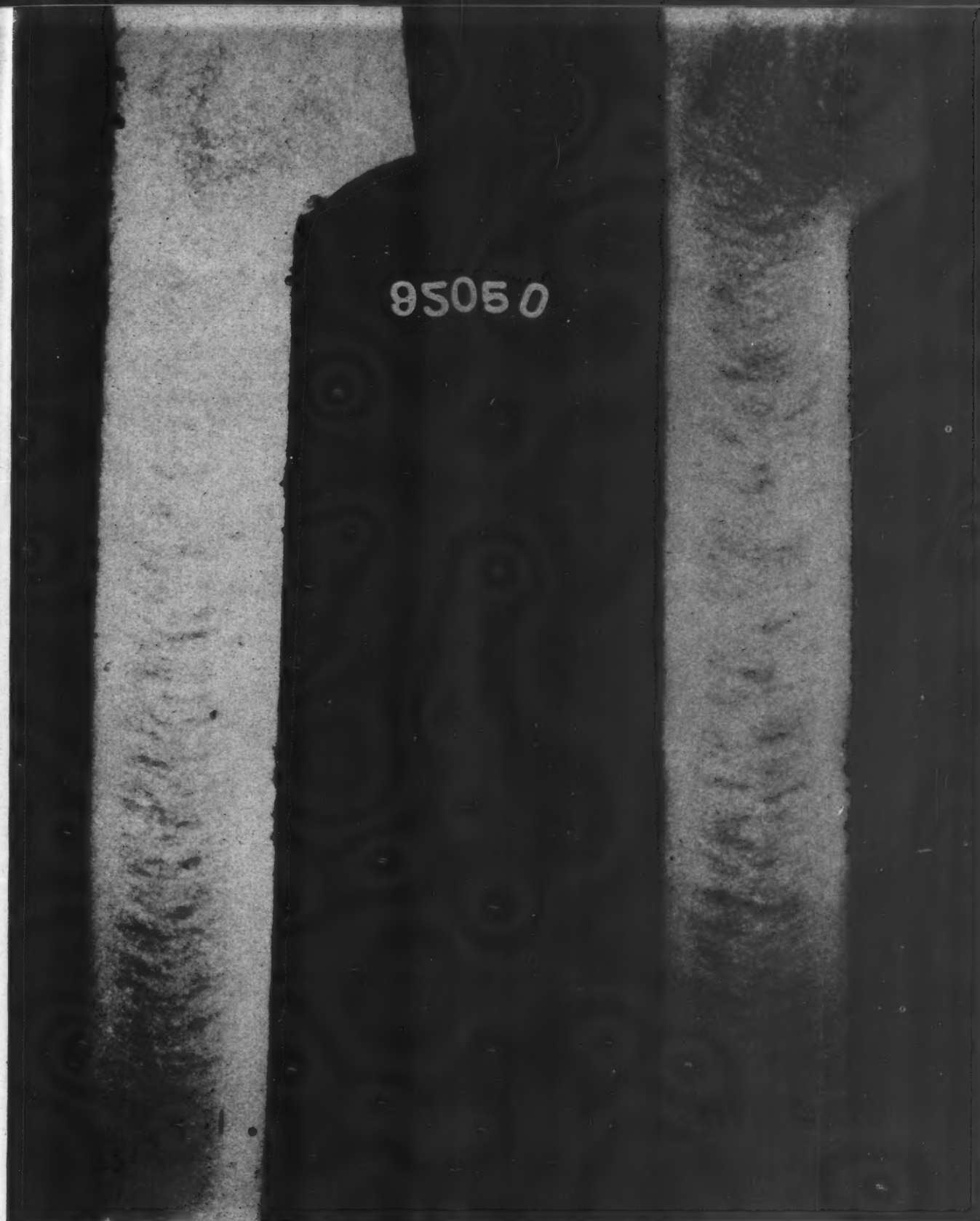
Figure 16, which will be discussed more fully in its proper place, shows photomicrographs at a magnification of  $\times 8$  and  $\times 50$ , at a location adjacent to and immediately below the lowest point of the surface set illustrated on the wedge of composition C of Fig. 3. Reference to these photomicrographs will show that the spongy shrinkage areas grade off into fine, angular porosity, a defect which will be termed microporosity.

The defects illustrated by Figs. 2, 3, 4, and 5 are all shrinkage caused by inadequate feeding of the top of the wedge, but these defects may manifest themselves as a smooth, rounded cavity, as shown by composition A of Fig. 2, or a widely distributed, spongy shrinkage zone ac-



*Fig. 11—Radiograph of a cast panel of commercially pure magnesium. The coarse grain is revealed by the mottling on the radiograph. While a number of very small blows formed by a reaction of the melt with portions of the mold are shown at the surface, there is no microporosity because this composition solidifies at*

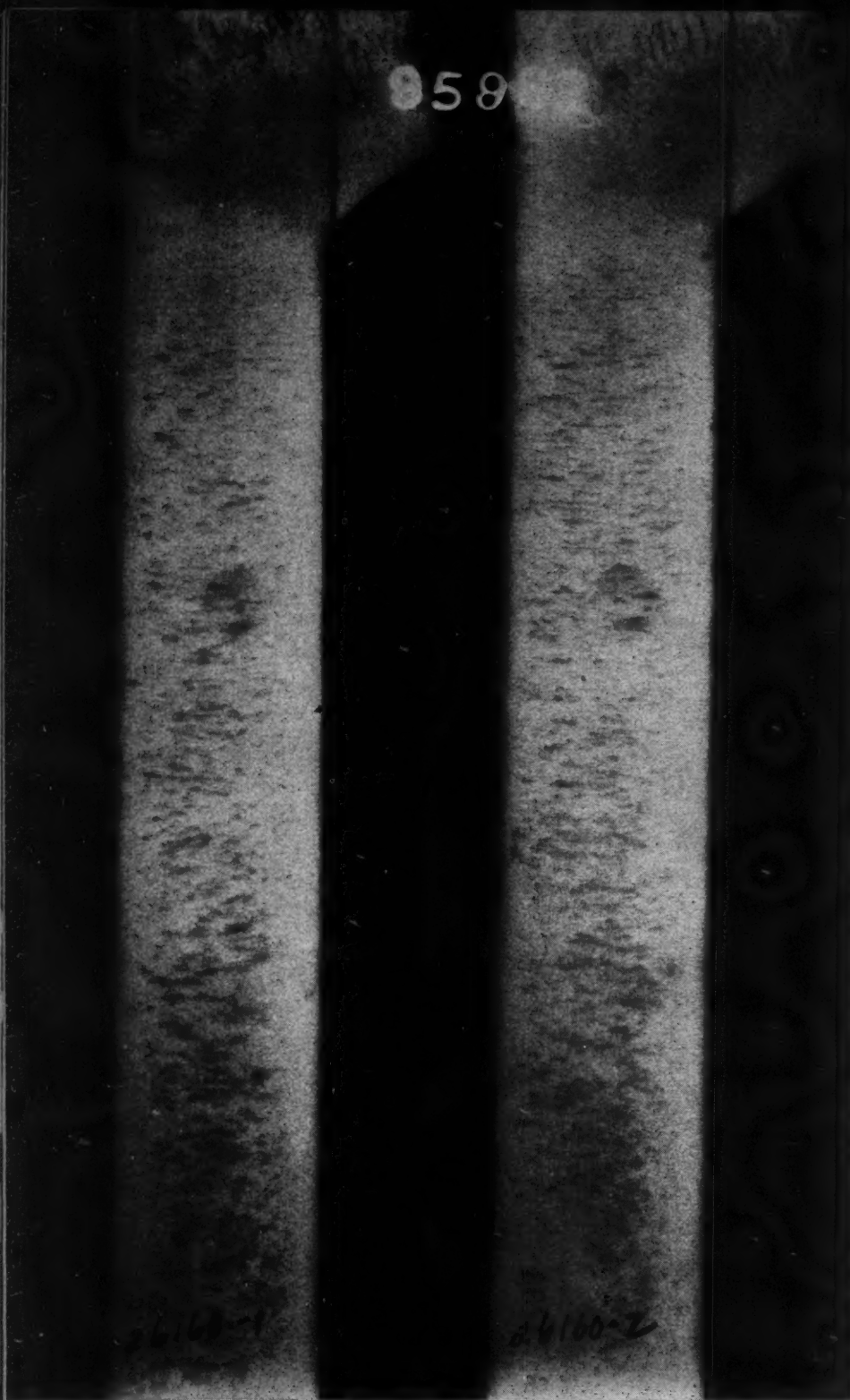
*substantially constant temperature. This radiograph should be compared with those shown by Figs. 12, 13, 14, and 15, which illustrate the effect of composition on the susceptibility of magnesium alloys to the formation of microporosity.*



*Fig. 12—This casting is entirely similar to the one shown by Fig. 11, except that 3 per cent zinc has been added to the melt. This alloy solidifies over a range of about 290 F without the formation of any eutectic. As a con-*

*sequence, it is quite susceptible to the formation of microporosity, and this defect is clearly illustrated on the radiograph. This figure should be compared with Figs. 11, 13, 14, and 15.*

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*Fig. 13—Radiograph of the same casting shown by Figs. 11 and 12, but the composition is magnesium with 6 per cent aluminum and 3 per cent zinc. This alloy solidifies over a range of approximately 510 F with the formation of a very slight amount of eutectic. As compared with the 3 per cent zinc alloy, shown by Fig. 12, this alloy solidifies over a wider range but slightly more eutectic is formed. The net effect is that this alloy, corresponding to ASTM-AZ-63 is probably slightly more susceptible to the formation of microporosity than the alloy shown by Fig. 12.*

companied or associated with microporosity, as illustrated by composition C, Figs. 3 and 5.

All of these melts were degassed but, since perfect degassing is not possible, the role of gas in the formation of the microporosity, illustrated by Fig. 16, is not precisely known. To make certain that an erroneous impression as to the cause of this defect is not implied, it is better to call this defect microporosity rather than microshrinkage. This gradation of localized shrinkage into microporosity will be considered in greater detail in its proper place.

*Effect of Gas Content.* It has been noted that when a melt solidifies a contraction in volume occurs. Unless properly fed this contraction will result in shrinkage. However, if a gas is evolved simultaneously with the contraction less localized shrinkage will occur. Instead, the unsoundness will occur more generally distributed in the form of pinhole porosity in eutectic-containing alloys, and in the form of microporosity in solid solution type alloys.

#### Gas Reduction

The first of these is illustrated by Fig. 6, which shows machined wedges of a copper-silicon alloy cast in green sand. Casting B was poured before fluxing with chlorine, and casting A was poured after fluxing. The chlorine flux has reduced the gas content of the melt, with the result that the gas evolution did not entirely compensate for the shrinkage. The area of localized shrinkage near the top center of the wedge is therefore apparent. However, in casting B the large quantity of pinhole porosity has prevented the formation of localized shrinkage. The appearance of this localized shrinkage and of the pinhole porosity is further illustrated by the radiograph (Fig. 7) of the same specimen.

The important point for the foundrymen is that aluminum castings poured from degassed melts require better feeding to avoid shrinkage than castings poured from gassy melts. More generally stated, castings which are to be free of pinhole porosity also require better feeding than castings which normally contain large amounts of pinhole porosity, if shrinkage defects are also to be avoided.

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*Illustrations of Typical Shrinkage Defects in Commercial Castings.* On the basis of the various types of shrinkage which have already been observed in the different types of alloys, it is to be expected that the same variations will occur in commercial castings of alloys. Figure 8 illustrates radiographs of shrinkage defects in two different alloys. Figure 8A shows shrinkage in No. 220 alloy, which is aluminum containing approximately 10 per cent magnesium.

The shrinkage resulted from inadequate feeding of a 4-in. section. It is obviously a generally distributed or spongy type of shrinkage, and it would be expected that the shrinkage would be similar to that which occurs in the aluminum-4 per cent magnesium because both alloys are solid solution type. Only the No. 220 composition produces a small amount of eutectic. In fact, the unsoundness revealed by Fig. 8A is quite similar to that in composition C of Fig. 5.

#### Shrinkage

A different form of more concentrated localized shrinkage is illustrated by Fig. 8B showing localized shrinkage in a 1/2-in. section of No. 355 alloy. This alloy contains a nominal 1.3 per cent copper, 5.0 per cent silicon, and 0.5 per cent magnesium.

This composition solidifies over a considerable range of temperature, but a large amount of eutectic solidifies at the end. It is known definitely that this is localized shrinkage and that it results from poor feeding in the casting. The exact explanation for the rather smooth-walled annular shape of the cavities is not known precisely.

Figure 9 illustrates two other types of shrinkage defects in aluminum castings. Both of these are radiographs, and Fig. 9A is of a 3-in. section of an inadequately fed No. 195 alloy, which is aluminum containing approximately 4.5 per cent copper and 0.6 to 0.8 per cent each of iron and silicon.

Alloy No. 195 solidifies over a considerable range in temperature, with only a small amount of eutectic at the end. It is to be expected, therefore, that the shrinkage defect would be less localized than in a pure metal or 100 per cent eutectic,



Fig. 14—This radiograph is of the same casting as shown by the preceding three photographs, except that the alloy contains 9 per cent aluminum and 2 per cent zinc, corresponding to ASTM-AZ92 alloy. This composition solidifies over a range of approximately 380 F with the formation of several per cent of eutectic. As compared with the alloy shown by Fig. 13, the range in solidification of the alloy shown here is much less and more eutectic is formed. As a result, this composition is much less susceptible to the formation of microporosity. As compared with the 3 per cent zinc alloy, shown by Fig. 12, the range in solidification is slightly more, but a great deal more eutectic is formed. The latter factor greatly reduces the susceptibility of this composition to the formation of microporosity.

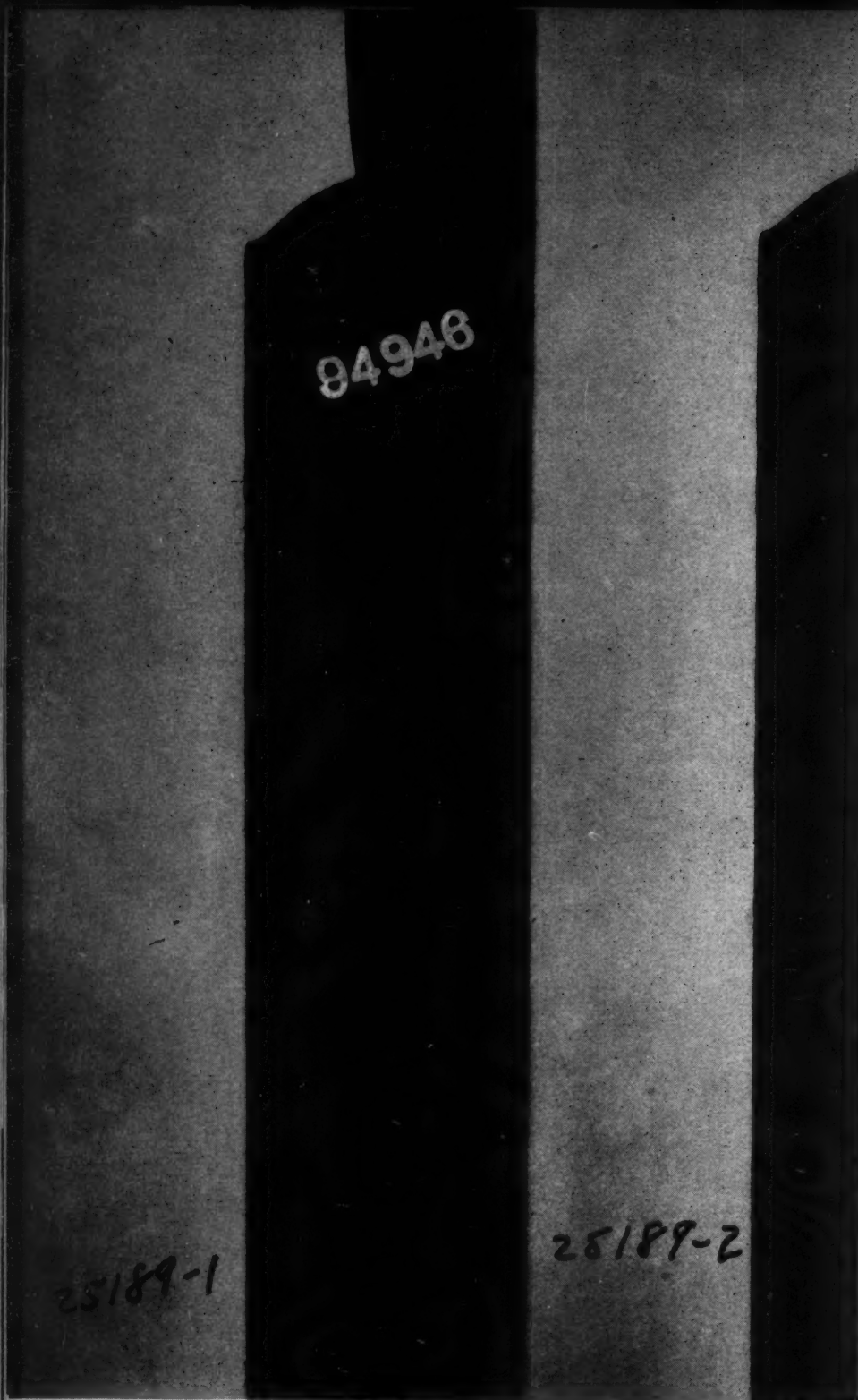


Fig. 15—Radiograph is similar to the preceding four, except that the alloy contains 8 per cent aluminum. This composition solidifies over a range of 230 F with the formation of slightly more eutectic than the 6 per cent aluminum, 3 per cent zinc alloy shown by Fig. 13, but slightly less eutectic than the 9 per cent aluminum, 2 per cent zinc alloy shown by Fig. 14, all other factors the same. As a result, this composition is far less susceptible to the formation of microporosity than the 6 per cent aluminum, 3 per cent zinc alloy shown by Fig. 13, but its susceptibility is comparable to that of the 9 per cent aluminum, 2 per cent zinc alloy shown by Fig. 14. These particular radiographs indicate that the 9 per cent aluminum alloy forms less microporosity than the 9 per cent aluminum, 2 per cent zinc alloy shown by Fig. 14. Other information indicates, however, that the two alloys are comparable and, if anything, the 9 per cent aluminum, 2 per cent zinc alloy is less susceptible to microporosity than the 8 per cent aluminum alloy because the greater amount of eutectic more than offsets its longer solidification range.

but not so widely distributed as in a solid solution type alloy represented by composition C in Fig. 3.

Figure 9B shows a typical, fairly localized surface shrinkage in a fillet of a No. 195 alloy casting of approximately the same composition as that of Fig. 9A. The surface appearance of this localized shrinkage in the fillet is illustrated by Fig. 10.

It is probable that the somewhat directional solidification in the casting has tended to make this defect quite precisely localized, as delineated by the radiograph. It should be emphasized here that, all other factors being the same, rapid directional solidification will tend to produce a sharper more localized shrinkage cavity where feeding is inadequate.

*Gradation of Shrinkage into Microporosity.* Microporosity is a defect characterized by small, more or less interconnected voids that are now well known to most light-alloy foundrymen. The effect of alloy composition, gas content of the melt, and degree of feeding provided, on the amount, size, shape, and distribution of microporosity in magnesium alloys has been described in separate papers <sup>2, 3, 4, 5</sup>.

#### Metal Affected

It is sufficient to point out here then that either aluminum- or magnesium-base alloys of the solid solution type, such as that represented by composition C of Fig. 3, are the most susceptible to this type of defect. On the other hand, a melt which solidifies at constant temperature, such as pure metal, almost never has even a slight trace of this defect. Likewise, alloys which solidify over a range in temperature, but which contain a large amount of eutectic, seldom contain this defect, although it may occur to a slight extent.

These principles are also illustrated by Figs. 11, 12, 13, 14, and 15, with accompanying captions. These show the effect of composition on the range in solidification and alloy type which in turn determine the susceptibility of magnesium and its alloys to the formation of microporosity.

With either aluminum or magnesium alloys, the point to visualize is that as the amount of liquid solidifying at constant temperature de-

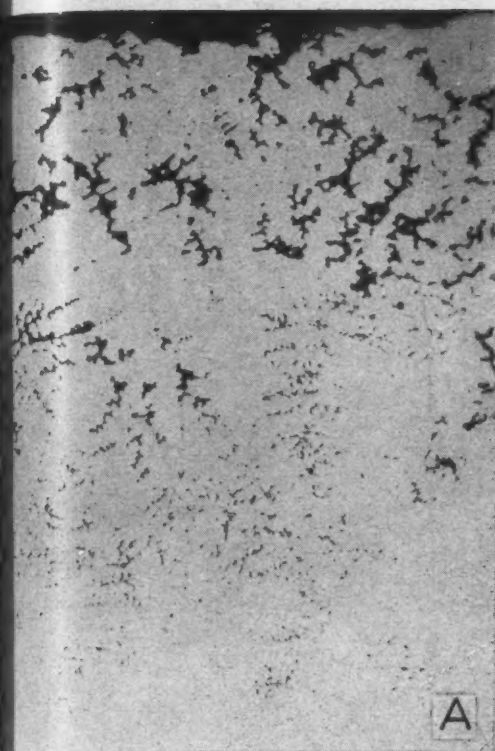
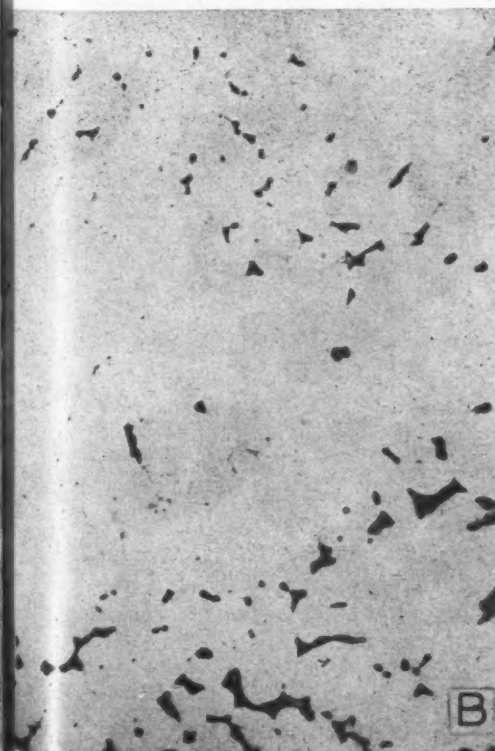


Fig. 16—(A) Photograph of a section taken from the No. 214 alloy wedge illustrated by Fig. 3, Composition C, in the zone adjacent to and just below the surface set. This photograph shows this spongy shrinkage at the top grading into microporosity below.  $\times 8$ . (B) Lower portion of the specimen illustrated by (A) but at a higher magnification to show the microporosity.  $\times 50$ .



creases from 100 per cent in pure metals or in 100 per cent eutectics to 0 per cent in solid solution alloys, with an accompanying general increase in solidification range, the tendency to form microporosity increases. With this change there is also an increasing tendency to form the spongy, widely distributed shrinkage illustrated by composition C, Figs. 3 and 5.

The gradation of localized shrinkage of the spongy type into microporosity has been noted and is illustrated by Fig. 16. This is further illustrated in Figs. 17 and 20. Figure 20, composition C, is the same as composition C of Figs. 3 and 5, but this wedge was poured from a gassed melt into a green sand mold.

Figure 17A at a magnification of  $\times 8$  shows the spongy shrinkage in the top of the wedge of composition C, Fig. 20, grading off into microporosity below the shrinkage. The photomicrograph shown in Fig. 17B is of the fine porosity in the lower portion of Fig. 17A at a higher magnification,  $\times 50$ , to reveal the microporosity more clearly.

#### Gassed Metal

Comparing Fig. 16 with Fig. 17, it is obvious that the gassed melt has produced a greater volume of microporosity, and the accentuation of this defect by the higher gas content is entirely evident. This principle, applicable to aluminum-base alloys, has also been fully established by data on magnesium-base alloys as described in other A.F.A. papers <sup>2, 3, 4, 6, 7</sup>.

Gradation of shrinkage into microporosity in magnesium alloys is illustrated by Fig. 18, which shows a vertical longitudinal section of an inadequately fed  $6 \times 10 \times 1\frac{1}{2}$ -in. plate of a magnesium alloy containing 9.4 per cent aluminum, 0.4 per cent zinc, and 0.25 per cent manganese, and degassed by chlorine fluxing.

Figure 18A shows a radiograph of a vertical longitudinal section of the plate with macroscopic shrinkage at the top and a heavy, coarse microporosity below. This gradation is better illustrated by the photomicrograph (Fig. 18B) at  $\times 12$ , showing the localized spongy shrinkage at the top, grading into microporosity below.

While one might arbitrarily and, with some basis of logic, sharply de-

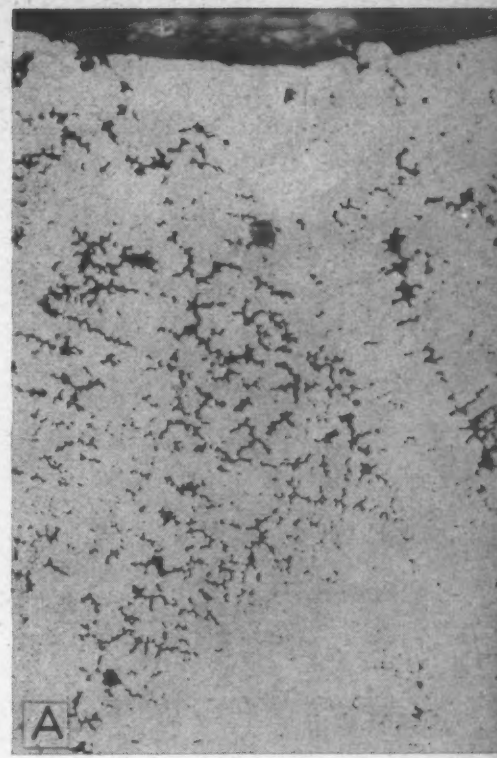
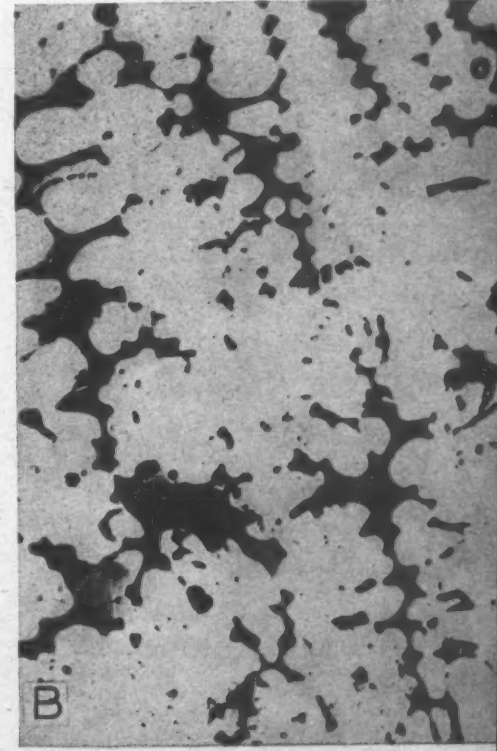


Fig. 17—These photographs are comparable to the preceding ones, except that these specimens were cut from the wedge illustrated by Fig. 20, Composition C. This also is No. 214 alloy, but in this instance the casting was poured from gassed metal, whereas the preceding one, illustrated by Fig. 16, was poured from degassed metal. (A)  $\times 8$ . (B)  $\times 50$ .



fine where localized shrinkage ends and microporosity begins in these particular illustrations, it is quite evident that it would be possible in commercial castings to have unsoundness which could be labeled either "shrinkage of a spongy type" or microporosity. Any satisfactory system of nomenclature must recognize the borderline defects.

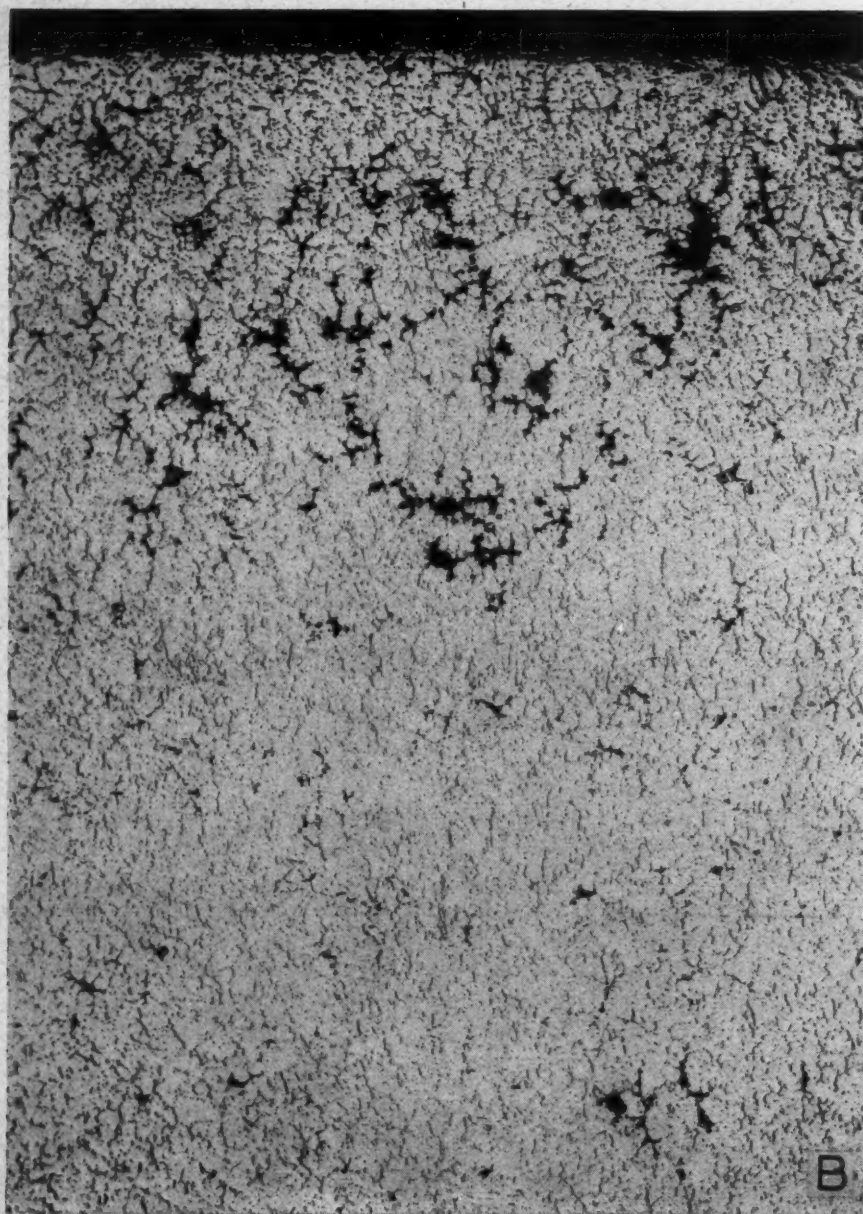
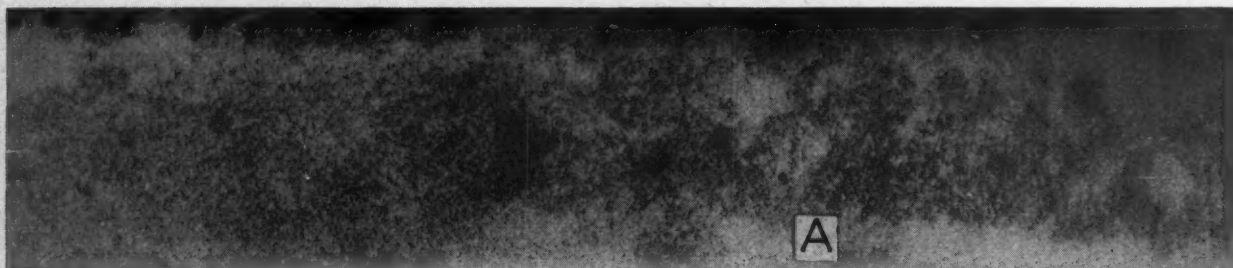
Gas porosity, it will be recalled,

results from the evolution of gas which was in solution in the melt. It is not uncommon for foundrymen and metallurgists to imply that gases from the green sand or cores were trapped in the metal, resulting in pinhole porosity. This is technically incorrect.

While the gas which is precipitated may have been dissolved from the vapors evolved from the core or

green sand, the melt first dissolves the hydrogen from this vapor, especially from the moisture, and then reprecipitates it from the melt during solidification, forming the pinholes. Trapped mold gases are not common, but when they do occur, they form a quite different type of defect.

Furthermore, it is quite common to attribute generally distributed gas



(pinhole) porosity to shrinkage merely because the pores are angular. This also is incorrect for reasons described elsewhere<sup>1</sup>.

*Effect of Composition.* The tendency for aluminum casting alloys to form pinhole porosity depends to a considerable extent upon their composition, as will be illustrated by Figs. 19, 20, 21, and 22. The castings represented by these four figures were poured from a gassy melt into green sand molds, employing the same wedge casting described previously.

#### Use Chlorine

All of these castings were prepared in the same way, and the melts were first degassed with chlorine, then each melt was gassed by the same amount of slaked lime. Figures 19 and 20 show photographs of machined sections of compositions A, B, C, and D, previously

*Fig. 18—(above) Radiograph of vertical 1/2-in. section cut from a plate 1 1/2-in. thick cast horizontally from a degassed melt of magnesium alloy containing 9.4 per cent Al, 0.4 per cent Zn, and 0.25 per cent Mn. Localized shrinkage of the spongy type is illustrated at the top, grading into microporosity below.  $\times 1$ . Left—Photograph of the same specimen illustrated above, but the unsoundness of the localized, spongy type shrinkage, grading into microporosity is illustrated.  $\times 12$ .*

described, while Figs. 21 and 22 illustrate radiographs of 1-in. sections of the same specimens.

The various amounts of pinhole porosity, illustrated by these figures, are a typical result of difference in alloy composition. The conclusions which may be drawn from these four figures, and from comparison of these four with the similar set represented by Figs. 2, 3, 4, and 5, are:

1. It is difficult to entrap hydrogen in the form of pinholes in commercially pure aluminum. Most of the hydrogen will escape from the top surface of the solidifying casting, particularly where the solidification is quite directional from the bottom upwards as it necessarily was in this wedge.

2. The mottling shown on the radiograph of composition *A*, Fig. 21, should not be confused with unsoundness. This mottling is the direct result of the grain structure of the casting. The columnar grains illustrated on the radiograph are quite typical for this composition.

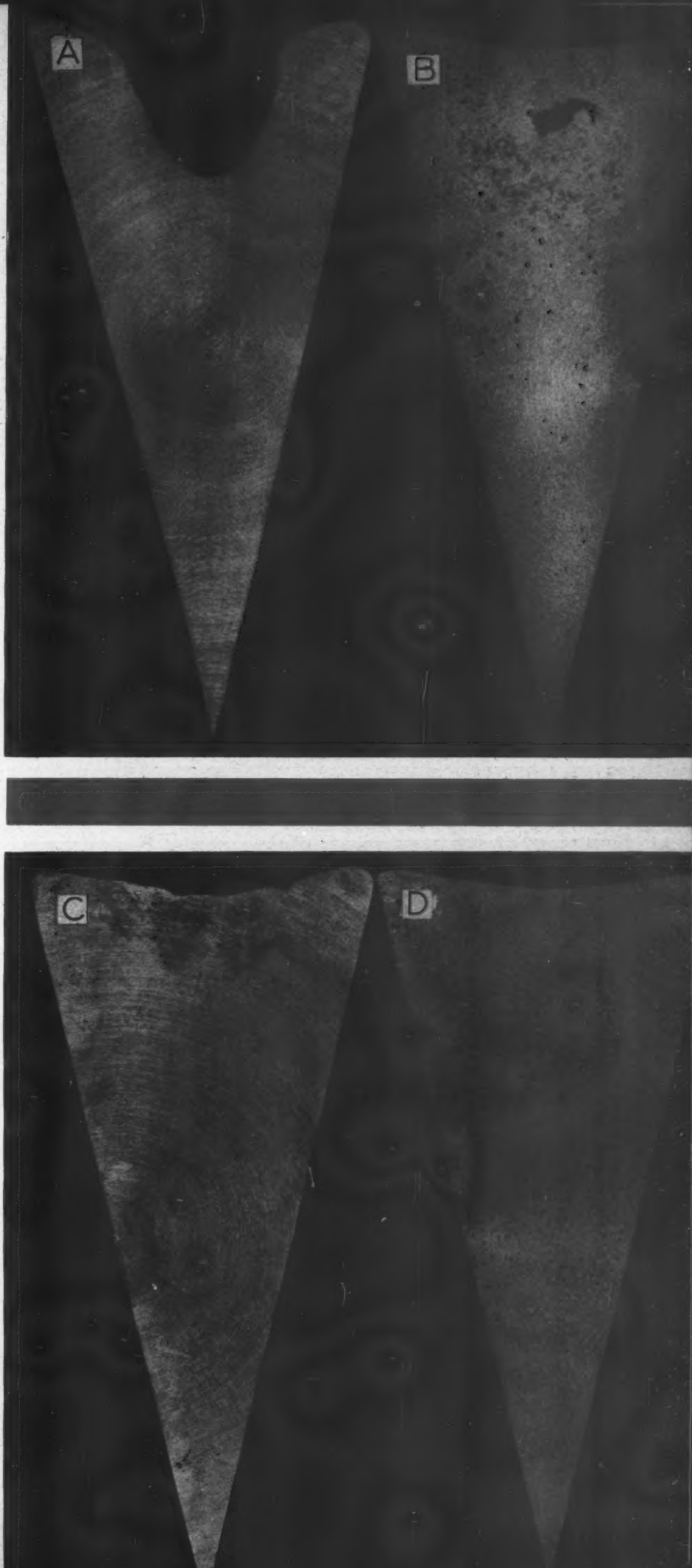
3. Some voids caused by hydrogen in the form of large, widely separated pinholes are illustrated by composition *B*, Fig. 19. It will be recalled that composition *B* is nearly, but not quite, a 100 per cent eutectic alloy. In any event, this alloy solidifies over a fairly narrow range in temperature, resulting in some entrapment of hydrogen in the form of pinholes.

4. Composition *D*, Fig. 20, represents a casting which solidifies over a considerable range but with the formation of a large amount of eutectic. This considerable range in solidification temperature facilitates the entrapment of bubbles of hydrogen, forming a larger number of these pinholes, visible on the machined surface, than was entrapped by composition *B*, Fig. 19.

5. The number of pinholes represented by entrapped hydrogen bubbles, shown by composition *B* and *D*, can best be estimated by the ap-

*Fig. 19—(right above) Machined sections similar to Fig. 2, except that gassed metal was poured in green sand.  $\times 5/6$ .*

*Fig. 20—(right) Machined sections similar to Fig. 3, except that gassed metal was poured in green sand.  $\times 5/6$ .*





pearance of the machined surfaces shown by Figs. 19 and 20. The radiographs of these alloys, shown by Figs. 21 and 22, are of 1-in. sections in which a large number of pinholes are shown on the film, even in the case of composition *B* which contains the least number.

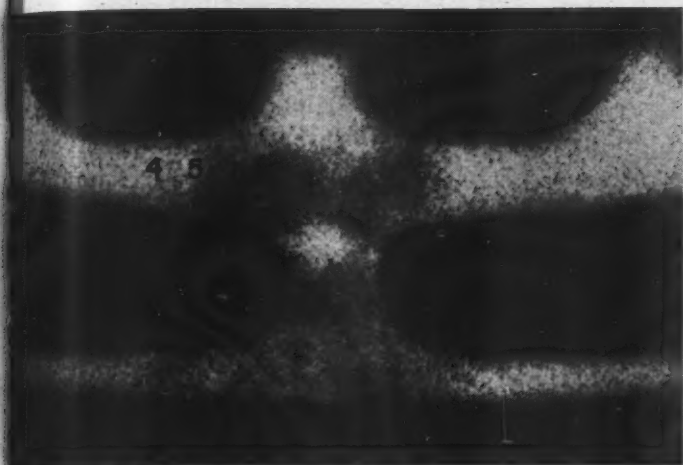
6. Composition *C*, which is a solid solution type, does not readily entrap hydrogen bubbles to form pinholes. However, it should be noted that it is entirely possible for an alloy of this type to contain a considerable quantity of pinholes, but it is much less likely to do so than alloys such as those represented by composition *D*. Instead, the solid solution type alloy represented by composition *C* contains microporosity which is greatly accentuated by the high gas content of the melt. This has been illustrated previously by Figs. 16 and 17, and described more fully elsewhere <sup>2, 3, 4, 5</sup>.

7. Comparing Figs. 19, 20, 21, and 22 of castings poured from gassy metal with those of Figs. 2, 3, 4, and 5 of castings poured from degassed melts, it is quite evident that there is a marked tendency for the gassy melts to produce less localized shrinkage.

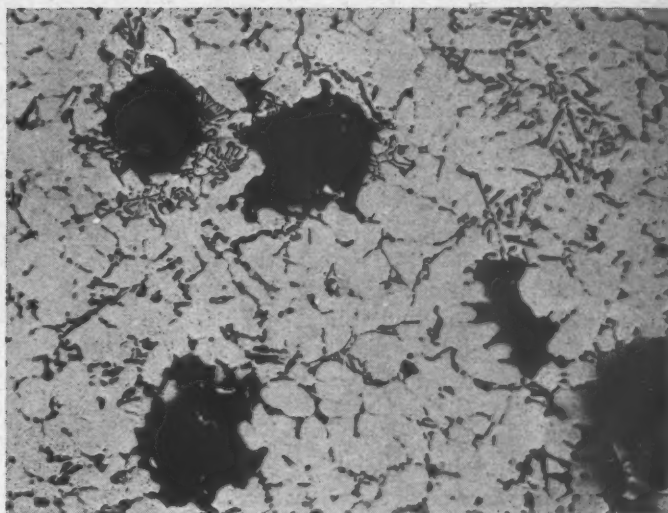
8. The gas porosity tends to be much lighter in the tip of the cone where solidification is rapid than at the large end where solidification is much slower. This is a typical effect of solidification rate. The radiograph of composition *D*, Fig. 22, shows a typical, high concentration of voids near the top center. The machined surface of this specimen contains no indication of localized shrinkage near the top. It is not possible to determine whether the high concentration of voids shown by the radiograph, Fig. 22, composition *D*, is caused by a high concentration of large pinholes or whether there is some localized shrinkage. It is probably a combination of both because

*Fig. 21—(left above) Radiographs of specimens shown by Fig. 19 which are similar to Fig. 4, except that gassed metal was poured in green sand.  $\times 5/6$ .*

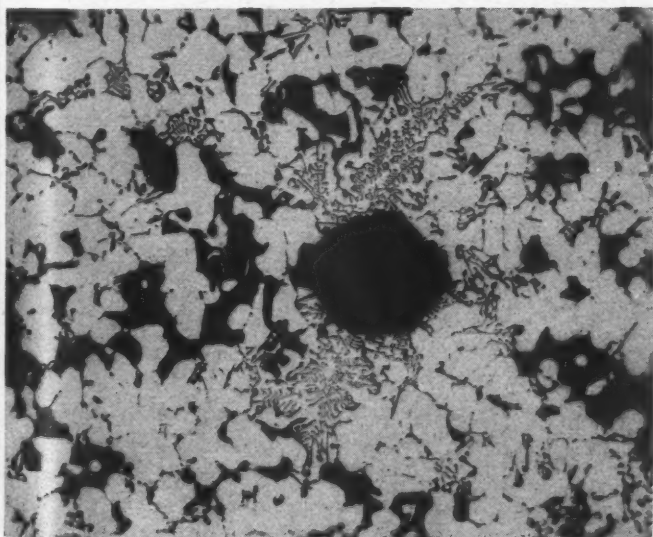
*Fig. 22 — (left) Radiographs of specimens shown by Fig. 20 which are similar to Fig. 5, except that gassed metal was poured in green sand.*



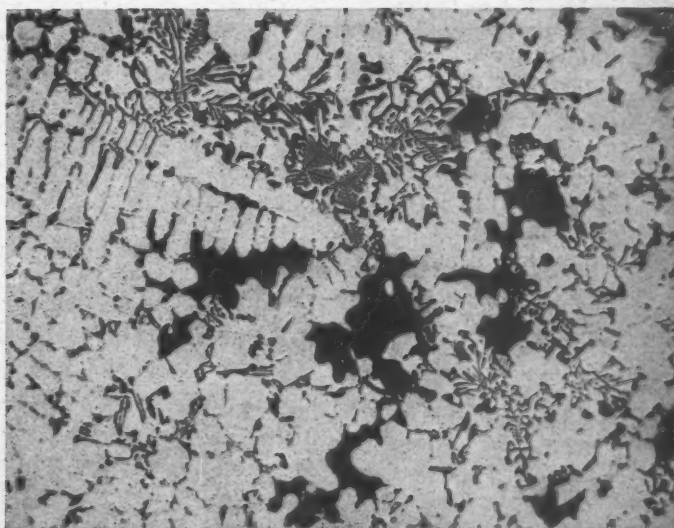
*Fig. 23—Radiograph showing localized shrinkage of a somewhat spongy type with pinhole porosity in an aluminum-copper-silicon alloy containing 3 per cent Cu and 7 per cent Si.  $\times 1$ .*



*Fig. 24—This photomicrograph shows the unsoundness present at location 4 illustrated on Fig. 23.  $\times 40$ .*



*Fig. 25—Photomicrograph showing unsoundness at location 5, illustrated on Fig. 23.  $\times 40$ .*



*Fig. 26—Photomicrograph showing unsoundness at location 6, illustrated on Fig. 23.  $\times 40$ .*

the concentration of localized shrinkage and the concentration of pinholes would be expected to be a maximum in this location.

A typical occurrence of a severe localized shrinkage of a somewhat general spongy nature combined with pinhole porosity is shown by Figs. 23 to 26, inclusive. Figure 23 is a radiograph of a section of an ironing buck of an aluminum 3 per cent copper-7 per cent silicon alloy.

Figures 24, 25, and 26 are photomicrographs at  $\times 40$  of unetched surfaces at locations 4, 5, and 6 shown on the radiograph (Fig. 23). This alloy solidifies over a range in temperature, with a large amount of eutectic at the end. The spongy shrinkage zone is quite localized. At location 4, only rounded to angular pinholes are evident. At location 5, pinholes and shrinkage are present. At location 6, only shrinkage is formed.

There is no question that gas was precipitated in the shrinkage zone, but the shrinkage voids were large enough to contain the evolved gas without the formation of the pinholes. This defective casting resulted from a considerable gas evolution and inadequate feeding. Had no gas been evolved, the voids in the general spongy shrinkage zone probably would have constituted a greater total volume, but they would have been still more localized.

The principle illustrated here, showing the effect of composition upon the susceptibility to the formation of pinholes in aluminum, probably also applies to the susceptibility of magnesium alloys to the formation of gas holes. However, since gas holes do not normally occur, and commercial magnesium compositions are largely confined to types A and C, composition effects have no great practical significance to the magnesium founder.

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(Concluded in February issue.)

## A.F.A. AIDS SCOUTS In Securing Merit Badge Awards

FOUNDRY GROUPS have an opportunity to familiarize young people with the advantages of a career in the foundry industry through participation, with civic groups and other organizations, in Boy Scout Anniversary Week, which this year will be observed February 8-14.

During celebration of the Boy Scout anniversary, some cities set aside certain days during which emphasis is placed on the functions of the scout movement and its importance to the cities and the country. A.F.A. chapters, through their educational committees, utilize the occasion to bring the castings industry before the boys since, if they become better acquainted with it, many will become interested and seek a career in the foundry.

#### Plant Visitations

Visits to local foundries can be arranged, or hikes to outstanding foundries or pattern shops. In many of the Eastern states, sites of historic foundries can be found; in Washington, D. C., there is a Foundry Church, and in all museums ancient castings are exhibited—all of which are of interest to the boys.

In their cooperation with local Scout groups, A.F.A. members can offer the boys assistance in earning the Foundry Merit Badge, which is among the awards intended to aid scouts in choosing a vocation. Few of the boys earn this badge, because they are not well enough acquainted with the castings industry and because facilities for performing the necessary work are not available to them.

At the recent Erie Foundry Show, Northwestern Pennsylvania A.F.A. chapter provided space for a booth, manned by scouts and supervised by area scout executives, where information regarding the Foundry Merit Badge was available. Northern California chapter is sponsoring a booth

at the Merit Badge Show, "Scout-O-Rama," at Oakland, Calif., February 20-22.

#### Coast Exhibit

For the Merit Badge Show at Oakland, plans call for a miniature foundry, including a molding machine in operation, and display of tools, equipment and supplies necessary to earn the Foundry badge. In addition, a scout Troop has been assigned to foundry practice, and an A.F.A. chapter member, who is a patternmaker and a Scout Master, is instructing the boys on making of patterns for the production of souvenirs incorporating the Scout insignia.

Arrangements have been completed for the entire Troop to visit a foundry and learn first hand general foundry operations. The scouts have demonstrated enthusiasm in the foundry booth preparations, and the chapter is assured that the exhibit will be highly successful toward acquainting the community with the foundry industry. The chapter will distribute at the show copies of the American Foundrymen's Association booklet, *THE FOUNDRY IS A GOOD PLACE TO WORK*.

#### Educational Committees Help

Chapter educational committees also cooperate with local Scout authorities in the activities of local Scout weeks and other events. Some foundrymen are scout leaders, and assist in acquainting the boys with the Foundry Merit Badge and arranging, through the chapter, for local foundries or trade schools to provide space, facilities and instructions necessary to earn the award. In such manner, the Association is introducing the castings industry to the boys in the Scout movement and enabling them to obtain information regarding foundry careers.

AMERICAN FOUNDRYMAN

# FOUNDRIY REFRACTORIES...

## THEIR PROPERTIES AND APPLICATION

C. A. Brashares  
Harbison-Walker Refractories Co.  
Pittsburgh, Pa.

OF THE COMMERCIAL REFRACTORY materials, fireclay refractories are used in largest quantities in the foundry industry. The properties of fireclay brick are frequently considered toward the end of securing those products which may be used to best advantage in the cupola and accessories, malleable furnaces, annealing furnaces, and other refractory constructions. Individual mention will be made of the various properties of fireclay brick, both physical and chemical.

### Pyrometric Cones

*Refractoriness.* Obviously, a material which is supplied for heat resistance should have a high fusion point. More accurately, the ability of refractories to withstand temperatures causing softening is referred to as the pyrometric cone equivalent (P.C.E.). Many factors influence the softening point of refractory materials. Because of these, the comparison of an unknown refractory with a standard and known refractory composition has been found to permit most satisfactory evaluation of the temperature-resisting qualities of the unknown.

Standard pyrometric cones are available, the bending temperatures

of which have been carefully determined. In testing a given refractory product, a small sample is finely ground and molded into a similar cone-shaped unit. This is then installed on a cone pat along with standard cones and heated according to a predetermined, definite schedule. At the point the sample cone is observed to bend and touch the refractory pat, the condition of the standard cones is recorded (Fig. 1). This permits satisfactory evaluation of the refractory qualities of the sample tested.

In discussing refractoriness of fireclay brick, it should be emphasized that this refers to the pyrometric cone equivalent determined as has been described, and not to the temperature which the particular brick will withstand (Fig. 2). Fireclay brick may have a P.C.E. of Cone 32½, corresponding to a temperature of 3131 F. However, under a load of 25 psi these brick will tend to show measurable deformation at a temperature of about 2250 F.

Furthermore, at temperatures in the neighborhood of 2250 F, this refractory may show some dimensional changes, even though little or no load is applied. These properties will be dealt with further.

*Chemical Analysis.* The chemical

composition of a refractory is extremely important but requires care in properly understanding its relation to a given set of service conditions. It is only necessary to consider the satisfactory application of highly siliceous brick where a refractory more basic in nature seems indicated in order to understand that the chemical analysis of a fireclay brick needs considerable interpretation to make it a useful guide. In fireclay brick, the ratio of silica to alumina is important in gaining the preliminary estimation of a given refractory. The iron oxide content is not especially important as long as it is held within reasonable limits.

### Physical Properties Important

Lime, magnesia, and alkalis tend to lower the refractoriness of fireclay brick, so the percentages of these are important. However, the effect of given percentages of lime, magnesia, or alkalis may vary through considerable limits, depending upon the brick in question. It might be said that chemical analysis provides a worth-while preliminary estimation of the refractory, but the physical properties generally are far more important.

*Porosity-Permeability.* In cupola work, it has long been recognized that low porosity is desirable in refractories, particularly when fluid and corrosive slags must be resisted. High heat duty fireclay brick may show porosities roughly within the range 10-30 per cent. Accordingly, the porosity of a cupola block may be an important consideration in the length of service life secured in a melting zone. Here again, other considerations must be taken into ac-

► **An outline of the important properties of the various refractories used in the foundry—indicating their practical meaning to the foundry operator and describing particular applications.**

Presented at a Refractories Session of the Fiftieth Annual Meeting, American Foundrymen's Association, at Cleveland, May 7, 1946.

count, since porosity in itself should not be the sole criterion used to estimate the performance which may be expected. Chemical composition may readily influence the service life.

For example, it is known that highly siliceous blocks may in some instances resist the fluxing action of the cupola slag better than less siliceous brick, even though the porosity of the former is considerably higher. This is further borne out by the splendid performance of silica brick in some cupola operations, where high steel charges are used and exceptionally severe conditions prevail. The silica brick have substantially higher porosity than the generally used fireclay cupola blocks.

#### Permeability Important

In more recent years, the importance of permeability in a refractory has been recognized. This property differs from porosity in that it provides a measure of the type or kind of pores, in addition to quantity. Where the pores in a refractory are connected, it can reasonably be expected that slag attack and corrosion may proceed much more rapidly than in a refractory of equal porosity, but one in which the pores are independent or only infrequently connected.

In the permeability measurement, air under pressure is passed through the refractory sample with definitely controlled and standard conditions. The result is reported as the volume of air passing through a unit thickness of the refractory in a given period of time.

The full import of permeability measurements has not been developed up to the present time. However, it has been interesting to note that superduty fireclay brick may have from three to ten times the permeability of dense high heat duty

fireclay brick. Since superduty fireclay brick has not been widely used in cupola operations, although frequent trials have been made, their higher permeability may possibly offer some explanation. In some non-ferrous melting furnaces, where the brick are in direct contact with the molten metal, certain low permeability-high heat duty fireclay brick have shown definite superiority over brick of similar chemical composition, but of higher permeability.

**Strength-Abrasion Resistance.** The mechanical strength of refractories has frequently been given undue attention. There are, of course, applications in which maximum mechanical strength is required, but for a great many refractory constructions the strength needed in a brick is only that which will insure handling up to the job without excessive cornering and breakage. The natural ap-

pearance of a mechanically strong brick is obvious, but often in obtaining high mechanical strength of product other much more important properties are sacrificed. This can also be a consideration in the handling of refractory brick around the plant. Where handling is rough, strong brick are required in order to arrive on the job in good condition.

Frequently, improvements in handling procedure may be made without material increase in cost. These handling improvements may then permit taking advantage of the other important properties in the brick that do not necessarily go along with the highest mechanical strength.

#### Strength Determinations

Methods of determining strength of refractories deal principally with the determination of cold crushing strength, modulus of rupture, and abrasion resistance. Cold crushing strength, according to the ASTM procedure, is determined on a 9-in. straight brick stood on end in the conventional testing machine. A load is applied until the brick is crushed (Fig. 3). The result is then reported in the load in pounds per square inch required to crush the brick.

The modulus of rupture is determined on the brick laid on flat in span across two knife-edge supports. Load is applied at the center of the span by the testing machine, and the result is reported in pounds per square inch according to the usual modulus of rupture formula. The determination of abrasion resistance is not as precise a test as either the cold crushing strength or modulus of rupture test. A commonly used abrasion test consists of a modification of the "rattler test" as used on paving brick. The samples are placed in a steel drum, along with a definite weight of iron balls. The drum is

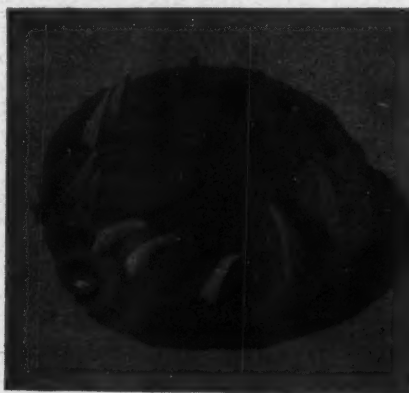
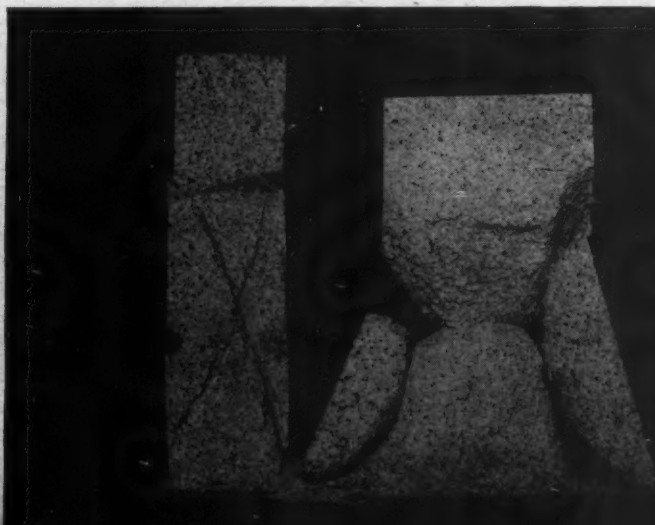


Fig. 1—(above) Appearance of test cones after heating.

Fig. 2—(left below) Fireclay brick after heating to a temperature of approximately 3150 F.

Fig. 3—(right below) Appearance of fireclay brick after ASTM crushing test.



then revolved a definite number of times, after which the brick are removed and weighed. From the weights before and after this test the loss is determined (Fig. 4).

In the malleable furnace side-walls and bottom, the strength of the refractory may be important. In the walls, the cutting action of misdirected flames may frequently be substantial. In the bottom, particularly in operations where cold charging is used, the brick may be subjected to considerable mechanical abuse. In the upper section of the cupola lining, depending upon the charging methods, abrasion may be an im-

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*Right—top to bottom:*

*Fig. 4—Typical appearance of blast furnace brick after 600 revolutions in paving brick rattler machine.*

*Fig. 5—Furnaces for testing load-bearing properties of refractory brick.*

*Fig. 6—Typical appearance of high heat duty brick after panel spalling test. Preheat temperature, 1600 C (2912 F).*

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portant factor in consumption of the refractory lining. In walls of many heating and annealing furnaces, negligible mechanical abuse is involved and, in such constructions, the best combination of over-all properties may be secured if exceptionally high mechanical strength is not demanded.

**Volume Stability at High Temperatures.** The importance of this property is rather obvious, since refractories of the proper quality after being installed are expected to be reasonably free from permanent dimensional changes. In the case of excessive shrinkage in service, wide joints may develop. With excessive shrinkage, the affected portion of the brick may be so structurally changed that it separates from the body of the wall.

High shrinkage may so alter the form of construction that failure results. With excessive permanent expansion, the furnace structure may be disrupted, the brick may be pinched off at the hot ends, or other similar undesirable conditions develop.

JANUARY, 1947



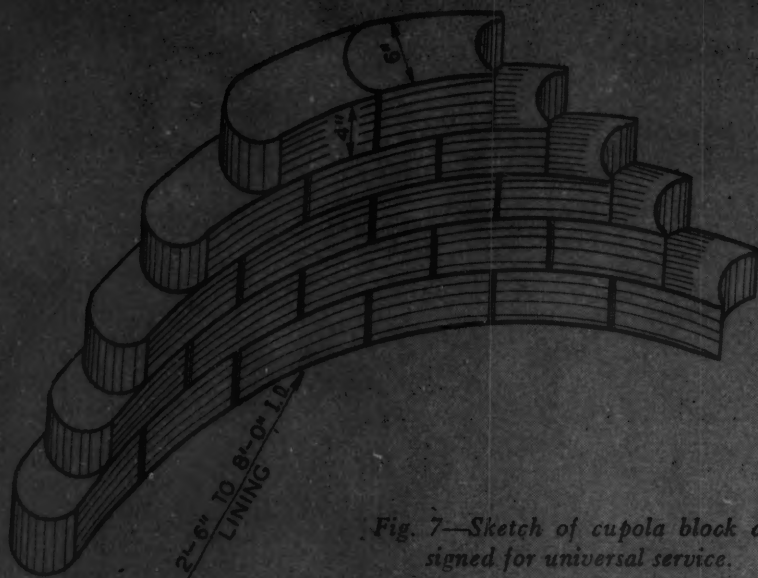


Fig. 7—Sketch of cupola block designed for universal service.

The test to determine the volume stability of refractories consists of heating samples of the full-sized brick according to a definite schedule of heat treatment. With high heat duty fireclay brick, a temperature of 2550 F is used, and this temperature is held for 5 hr. With the superduty fireclay brick, the reheat temperature is 2910 F, also held for 5 hr. After the furnace has been allowed to cool, the brick samples are measured to determine dimensional changes which have taken place as a result of the heating.

#### Bung Brick

Of the commonly used foundry refractories, bung brick are one class which should be volume stable at high temperatures. This is also true of superduty and high-alumina brick which are used in malleable furnace bottoms. In the cupola, it is naturally desirable that volume stability be maintained with the refractories, but with the relatively lower temperatures and the increased importance of other properties the volume stability of cupola refractories is not generally the major consideration.

**Strength Under Load at High Temperatures.** In foundry practice, there are relatively few constructions wherein the brick are called upon to withstand heavy loads in the high temperature range. However, in some furnaces, there may be piers

supporting relatively heavy loads and, should these piers be immediately adjacent to the fireboxes, the load-bearing properties may be important.

The test for load-bearing properties is conducted in a small cylindrical furnace (Fig. 5). The 9-in. brick are stood on end and a load equal to 25 psi of cross section applied to the  $4\frac{1}{2} \times 2\frac{1}{2}$ -in. face. The high heat duty fireclay brick are subjected to a temperature of 2460 F for  $1\frac{1}{2}$  hr. and the superduty fireclay brick to a temperature of 2640 F for the same time.

Under the load, the brick tend to subside, depending upon the amount of liquid formed within the brick structure and the lubricating effect of this liquid on the still solid refractory particles.

#### Load-Bearing Properties

It was mentioned that under a load of 25 psi the high heat duty fireclay brick tend to subside at a temperature of approximately 2250 F. The superduty fireclay brick support the same load to a higher temperature, namely, in the range of about 2330 F, and intermediate heat duty brick will support this load at a considerably lower temperature, approximately 2175 F.

Where conditions of load and temperature must be resisted, it frequently is necessary to go to the

high-alumina brick, especially those containing corundum. These brick have load-bearing properties far exceeding the high heat duty fireclay brick, or even the superduty fireclay brick.

**Spalling Resistance.** Resistance to spalling has been given a great deal of attention by refractory users in all fields. This may be because failures from spalling are so spectacular. Spalling may be caused by a great number of conditions; therefore, only the most general will be considered here.

#### Temperature Shock

Before the advent of the superduty fireclay brick, it usually had been considered that a coarse grind and relatively light burn were important in high heat duty fireclay brick if the brick had to withstand substantial temperature shock. High porosity was thought desirable to achieve spalling resistance. In the superduty fireclay brick, extremely high density and low porosity were achieved; furthermore, these brick frequently were extremely hard burned.

However, these refractories showed exceptionally high resistance to thermal shock. The results so obtained have not discounted the previous experience with coarse-textured, light-burned fireclay brick, but have demonstrated that spalling resistance is not the relatively simple matter previously considered.

#### Resistance Test

The laboratory test for thermal spalling resistance consists of installing fourteen 9-in. straights in the panel which forms the door of a test furnace. This panel is given prescribed heat treatment for 24 hr., which in the case of high heat duty fireclay brick is at a temperature of 2910 F, and with superduty fireclay brick, 3000 F. Following the heat treatment the panel is alternately exposed to the cooling of a blast of moist air and to heating at 2550 F. This schedule is continued for a given number of cycles, following which the loss in weight of the panel is determined (Fig. 6).

There are a number of constructions in foundries in which the spalling resistance of the refractory is most important. For example, spalling conditions may be severe in the upper sections of cupolas. Where

charging methods are such that the upper lining is not subjected to excessive abrasion, some advantage may be taken of modifications in texture of the cupola blocks to secure improved spalling resistance.

Another important construction, insofar as spalling resistance of the refractories is concerned, is in malleable furnace bungs. Here the refractory is exposed not only to high temperatures, but to such heat shock as may be involved in starting up the furnace, or in removing and replacing the bung brick. In the hand-fired malleable furnaces, loose-textured, handmade bung brick frequently serve satisfactorily.

### Dimensional Tolerances

In previous years when most of the furnaces were so fired, handmade brick were generally used. However, with the introduction of the powdered-coal firing more severe conditions resulted. Accordingly, the present bung brick was developed. Most bung brick are now made by the power-pressed process. They are not only more resistant to thermal shock, but also have desirable close dimensional tolerances made possible by the power-press process.

It frequently is desirable to consider the spalling resistance of refractories in the construction of heating and annealing furnaces. These furnaces may operate at relatively low temperatures, and intermediate or low heat duty brick appear adequate. However, temperature changes over the period during which the furnace is in operation may be sufficient to produce cracking and spalling of the intermediate or low heat duty brick. High heat duty brick, though not required for the temperature involved, nevertheless do provide a margin of quality as far as spalling resistance is concerned.

### Cupola Blocks

Many types of spalling are caused by conditions other than temperature shock. For example, insufficient provision for thermal expansion may cause pinching and spalling of refractories. Improper design of arches may be another cause. In the cupola, use of cupola blocks having the taper not fitting the circle to be turned may result in pinching and spalling of the cupola blocks. A

means of insuring a good fit may be in the use of a cupola block designed for universal service (Fig. 7). Another advantage of this block would be in the simplification of stocks where a number of different sizes are required. Trials now in progress should demonstrate the utility of this design.

## DISCUSSION

*Chairman:* C. E. BALES, Ironton Fire Brick Co., Ironton, Ohio.

*Co-Chairman:* C. S. REED, Chicago Retort & Fire Brick Co., Chicago, Ill.

*MEMBER:* Would the speaker elucidate briefly on the basic principles of selecting the proper cupola block, considering the temperature, chemical erosion, and abrasion conditions?

*MR. BRASHARES:* We cannot generalize too much on cupola brick from one foundry to another. There are the high production shops with severe service as contrasted with those in which relatively moderate conditions prevail. It has been the belief for some years that a good cupola block should have low porosity.

There may be some difference of opinion regarding the importance of low porosity, but in any event, I believe equally or more important is the property of low permeability. Assuming that the consideration is limited to high heat duty fireclay brick and that the refractoriness of this class is met, then the qualities of low permeability and low porosity are generally believed important.

As to abrasion resistance, this property is frequently over-emphasized. For example, during the past few years a number of small foundries have changed to a less abrasion-resistant brick for the top portion of their cupolas. Where previously these foundries used a dense, extruded, hard burned brick in this section, they have obtained improved results by using a more open textured handmade refractory.

While this handmade brick may not be the type usually preferred in this section, its more open texture apparently permitted higher resistance to spalling. Where spalling was a greater factor than abrasion in the destruction of the refractory, then it is readily understandable that the handmade brick should give the better results. Here again, we should not generalize too extensively from a few examples, even though substantial savings resulted at these particular plants.

The chemical attack on cupola blocks, particularly in the melting zone, is an important consideration. Since high heat duty fireclay brick may show a silica content of 50 up to 75 per cent or even higher, the range in chemical composition is rather wide. Silica is known to be resistant to iron oxide attack, so increasing silica content in a fireclay brick may be important toward diminishing chemical attack. It is of interest to note that in severe operations

where the charge contains a high steel content, even silica brick containing 95 per cent  $\text{SiO}_2$  have been used successfully.

*MEMBER:* How should the foundryman evaluate a given product furnished by a brick manufacturer in order to find out why a superduty brick in one case will spall, and in the other case will run to greater erosion than the one that has spalled? Is the examination of a fracture of the brick with regard to grain size of any help in judging whether the right brick was selected, or whether it went somewhat beyond the line of permeability?

*MR. BRASHARES:* The examination of fracture is very worth while. The importance of grain sizing, however, may be somewhat questionable. Assuming that cupola blocks fit the circle in which they are used and that pinching is not a factor, nor are the blocks broken by impact, then a rough fracture usually denotes thermal spalling. This results from temperature shock caused by rapid heating or cooling.

A smooth appearance generally denotes chemical attack. Where spalling may be followed by substantial chemical attack, some difficulty is experienced in identifying the spalling. In evaluating a cupola block for the section in which the major amount of wear in a given cupola takes place, it is desirable to consider not one property of this block, but several. Those which are generally of greatest importance are porosity, permeability, chemical analysis, and spalling resistance. Undue emphasis on a single property frequently leads to false conclusions.

*MEMBER:* Would you recommend a maximum specific pressure for acid and basic brick, considering the burning qualities?

*MR. BRASHARES:* The actual crushing strength, cold, of most refractories is far in excess of any loading they are generally called upon to withstand in service. However, it should be kept in mind that the load a refractory will withstand cold is far different than that which it will bear at higher temperatures. A high heat duty fireclay brick may have a cold crushing strength of 2000 psi. However, under a load of 25 psi, it will tend to subside to some extent at a temperature of about 2250 F.

Increase in load and temperature will cause further increase in the subsidence. Therefore, we should consider that with fireclay brick subsidence under load is gradual. With silica brick, the most acid commercial refractory, subsidence takes place through a very narrow range. For example, a good silica brick under a load of 25 psi will withstand a temperature in the range of 2950 F. Failure of the silica brick under load at high temperatures is by shear rather than gradual subsidence.

Magnesite brick, the most basic commercial refractories, also show this same type of failure under load at high temperatures, although their softening range may be slightly greater than with silica.

# GYPSUM CEMENT--PRACTICAL PATTERNMAKING APPLICATIONS

E. H. Schleede  
United States Gypsum Co.  
Chicago

GYPSUM CEMENT has many practical applications in the patternmaking field. Widely applicable patternmaking procedures are illustrated in this paper. A paper<sup>1</sup> previously presented by the writer set forth the basic principles of working with gypsum cements. All examples cited in the present paper are further applications of these basic methods.

**Checking a Core Box by "Book-ing" Method.** The problem of checking a core box is common in all pattern shops. Generally, a gypsum cement mix is used which is thin enough to pour into the cavity. However, this method has several shortcomings:

1. To make the gypsum cement mix thin enough to pour into the cavity, an excessive amount of water is required. This always results in a weak check cast.

2. The cavity can not be vented properly and does not fill completely. Usually, several casts must be made before a satisfactory one is produced.

3. The cast can not be reinforced properly. Either reinforcements can not be used, or if used can not be placed correctly.

4. Core boxes without a port of entry can not be checked.

<sup>1</sup>E. H. Schleede, "The Use of Gypsum Cements in Pattern and Model Making," TRANSACTIONS, American Foundrymen's Association, vol. 52, p. 1271 (1944).

In order to "book a core" it is essential to select a gypsum cement adaptable to this method. The requirements of a gypsum cement for this type of work are:

1. Long "period of plasticity."
2. Sufficient plasticity so that the excess material will squeeze out when pressure is applied.
3. Setting time of 20-25 min.
4. Low setting expansion so that the cast will be less difficult to remove.
5. High initial strength to reduce breakage when removing a freshly cast core from the cavity.

In making a cast by the "book-ing" or "squeeze-out" method, the following procedure is used:

1. The core box or mold is treated with a separating medium. Clamps or other devices which are needed to apply pressure to the mold should be ready for use. Any necessary reinforcements should also be in readiness.

2. A mix at normal consistency is then made, and the material is in-

troduced into the open halves of the core box with a spatula or similar tool (Fig. 1). As the "period of plasticity" progresses, the cavity in both halves is filled. Metal reinforcements are then imbedded where needed.

3. The progress of the setting action must be watched closely. The proper time to "book" the core box is when the setting action has reached the point where the mix will not slip out of the core box as it is being inverted. As soon as the mold halves are in register, they should be "driven home" quickly and evenly, thus squeezing out the excess material. Constant pressure must be applied to the mold during the "squeeze-out" to prevent surface scaling on the cast. Intermittent squeezing breaks the bond between the body and the surface of the cast.

4. Wedges are used to separate the mold halves evenly (Fig. 2). The mold should be tapped sharply to release the cast if it has not completely released from both halves. Usually, a fin of about 0.010 in. thickness is present at the seam of the gypsum cement cast (Fig. 3).

Castings of thin cross section, which could not be cast by any other method, can be made by using this gypsum cement "squeeze-out" technique.

**Correcting a Pattern for Metal Shrinkage.** When a patternmaker is confronted with the problem of adding "shrink" allowance to a pattern, he has three methods from which to choose:

1. Cutting the pattern into multiple sections and patching gaps which are created. This gives a temporary pattern. A white metal casting generally is made from this tem-

► **The skilled craftsman must know the materials with which he works—their properties and limitations. Gypsum cement supplies the patternmaker with yet another tool to meet the problems of his exacting craft. With a knowledge of gypsum cement characteristics, and his own ingenuity, the patternmaker will find many practical applications for this versatile material.**

porary pattern. The resultant white metal pattern is then "worked over" and trial castings are made until a satisfactorily adjusted pattern is achieved.

2. Making a new pattern with the correct "shrink" allowance.

3. Utilizing a type of high expansion gypsum cement which expands sufficiently upon setting to compensate for the metal shrinkage. The amount of expansion of this gypsum cement is controlled by the amount of water used in the mix. This method is less expensive and requires less time than do the first two methods.

#### Shrinkage Recovery

High expansion gypsum cement has the highest setting expansion of any known gypsum cement product. It can be used for shrinkage recovery when the dimensions of the original model need to be increased uniformly, or for other uses where high expansion characteristics are wanted.

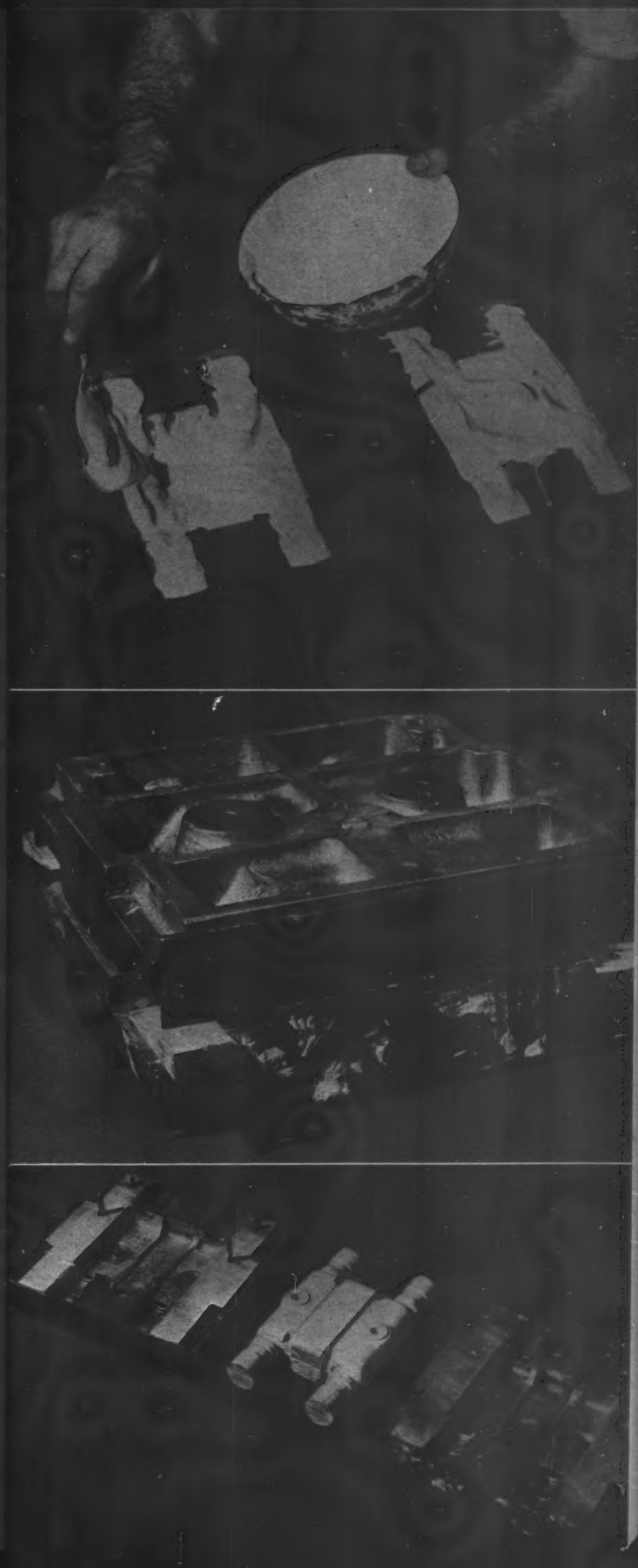
A material such as this has many uses in the metalworking industry. One example of a practical use for this material is in the production of core dryer patterns. In the jobbing foundry field, it often happens that core dryer patterns are not furnished with the pattern equipment. In this case, first step in the procedure for producing a dryer pattern is to cast a core of high expansion gypsum cement. Cast a core in the core box; when the mix sets, remove the core;

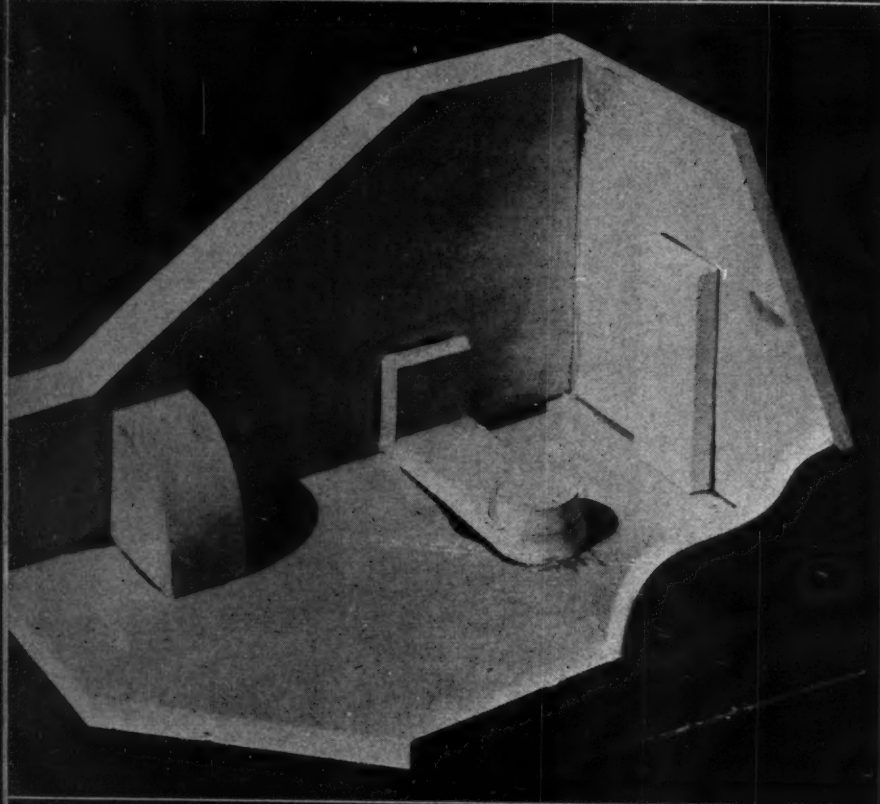
*Right—Reading from top to bottom:*

*Fig. 1—Making a cast by the "booking" or "squeeze-out" method. The mix is placed in the cavity with the aid of a spatula. Reinforcements may be placed in their proper positions as desired.*

*Fig. 2—Separation of the two halves of the core box is accomplished with the aid of wedges driven in evenly at the corners of the mold. By wedging in this manner, a mechanical release is effected.*

*Fig. 3—The cast after removal from the core box. A thin fin, not exceeding 0.010 in., generally is left between halves.*





allow it to expand; then seal the cast, apply a separating medium, and cast the dryer pattern.

**Characteristics.** High expansion gypsum cement displays an unusual characteristic in comparison to other gypsum cements. All other gypsum cements have a normal setting expansion of approximately 0.002 in. per in., maximum. However, in high expansion gypsum cement, this property is greatly exaggerated, and it is possible to achieve expansions up to 0.02 in. per in., or approximately ten times the expansion of other gypsum cements. The amount of expansion is controlled by the water to gypsum cement ratio of the mix. A lower water content in the mix will cause a higher expansion.

#### Expansion Rates

Approximately 75 to 85 per cent of the expansion occurs in about 2 to 2½ hr. Approximate maximum expansion occurs in 10 to 12 hr after set. Linear expansions of 2.0, 1.7, and 1.1 per cent are obtained with water to gypsum cement ratios of 28:100, 35:100, and 40:100, respectively. These proportions are by weight.

High expansion gypsum cement is handled somewhat differently than regular gypsum cements. In using high expansion gypsum cement, both the water and the material must be accurately proportioned to obtain the desired degree of expansion. The

*Left—Reading from top to bottom:*

*Fig. 4—Gypsum cement pattern stock can be shaped with a plane.*

*Fig. 5—An example of the use of pattern lumber. All the joints have been primed with cut shellac and then glued together with burnt shellac. Fillets may be run in with small, new mixes of gypsum cement.*

*Fig. 6—Completely assembled male die made in several parts from gypsum cement. The joints and blending are discernible. The female die is similarly assembled.*

proportions suitable for a particular project must be selected by the user.

High expansion gypsum cement, between the time of its original mix and initial set, has a peculiar, somewhat fluffy texture. Even though it is a heavy mix, it does not have a sharply defined setting action, but rather a gradual loss of plasticity.

Initial set occurs shortly after the material loses its gloss. After this period has been reached, close attention should be paid to the progress of the setting action to determine when the cast has set. The temperature of the cast will rise when the set occurs. As soon as this heat can be felt, the cast should be removed from the object over which it has set; thus unhindered expansion may take place.

If this is not done, the product will distort in proportion to the degree of confinement. The high expansion gypsum cement cast should be allowed to expand undisturbed for 2 to 2½ hr to get the full expansion. During this period, the cast will froth and shed water, and a somewhat sour-smelling gas will be emitted. This is a natural reaction of the material and should cause no alarm.

#### Additional Expansion

A cast of high expansion gypsum cement can be made to expand further after the original expansion has taken place. This additional expansion, which will not be as great as the original, can be induced by soaking the set cast with water.

If the expansion thus achieved is not sufficient, the entire process may be repeated as often as necessary to obtain the desired expansion by using the previously expanded cast as a starting point. Each set cast must be sealed and coated with a separating medium before making another cast.

**Production and Use of Gypsum Pattern Stock.** A thorough understanding of the production and use of gypsum cement pattern stock enlarges the field for application of gypsum cements to patternmaking. It permits the pattern shop to produce easily, quickly and economically patterns which are more dimensionally stable than wood and will not delaminate in storage.

Gypsum cement pattern stock can be produced in any desired thickness. In larger work, reinforcements,

such as long hemp fiber, can be incorporated in the gypsum stock. Any time after the gypsum cement has set, the material can be fabricated and assembled into the desired shape.

In order to work gypsum cement stock properly, it should always be kept moist. If it has dried out, moisten it with water before attempting to work it. This does not affect the stability of gypsum cement stock. If it is not kept moist, smooth cuts can not be produced because the material will chip ahead of the tool. The width and length of gypsum cement stock is limited only by the size of the table upon which the gypsum stock is cast.

#### Reinforcing Method

If only one face of the gypsum stock must be smooth, integral reinforcing ribs can be built on the back of the stock. When a pattern is assembled from this type of gypsum stock, the back of the stock is roughed up and the joints of the component parts of the pattern are cemented together with hemp fiber bats saturated in a new mix of gypsum cement. Nails may be driven into the stock before the bats are applied, thus furnishing a mechanical bond.

Figure 4 shows how gypsum cement pattern stock can be shaped with a plane, and Fig. 5 illustrates how gypsum cement stock can be assembled.

**Making a Follow-Board.** A frequent pattern shop problem is making a properly fitting follow-board. An irregularly shaped piece of work or one which is to be "backed out" to metal thickness requires a follow-board. This follow-board supports the pattern in handling and during the sand ramming.

#### Pattern Support

Generally, when the follow-board is made of wood, as few ribs as possible are used for support. Frequently, the result is a follow-board which provides insufficient support for the pattern to withstand the sand ramming.

In making a gypsum cement follow-board which will fit perfectly, the pattern is covered with several thicknesses of a high-wet-strength tissue. The tissue is moistened by slipping appropriately sized sheets

through water and placing them on the pattern. They are then brushed into intimate contact with the pattern. The bristles of the brush should not be coarse enough to tear the tissue. Several thicknesses of tissue are applied, and any wrinkles which may form can be disregarded.

#### Removing Tissue

After the entire surface of the pattern to be included in the follow-board has been covered with several thicknesses of tissue, a mix of gypsum cement is cast over the pattern. To make a stronger, lighter follow-board, hemp fiber reinforcements may be used.

As the gypsum cement reaches the final stages of its "period of plasticity," a piece of plate glass is pressed onto the gypsum cement, thus providing a flat base.

As soon as the gypsum cement goes into its initial set, the pattern should be separated from the follow-board and the tissue quickly removed. This should be done before the final set because it is difficult to remove the tissue after the gypsum cement has reached its final set.

The tissue is used for two reasons:

1. It acts as a separator to enable the pattern to be separated from the follow-board before the gypsum goes into its final set.

2. It provides sufficient clearance between the follow-board and the pattern so that the pattern may be easily removed from the follow-board.

A follow-board produced in this manner will have a rough appearance, but it does provide the proper support for the pattern.

**Example of Gypsum Cement Pattern Made by Combining Basic Forming Methods.** Frequently, it is necessary to make a pattern of varying contour and to combine sections. The basic methods of forming molds and shapes are used.

Figure 6 shows a completely assembled male die which was made in several parts, using gypsum cement. The female die is similarly assembled. It is obvious from the illustration that this die or pattern is used to produce a serving tray.

#### Conclusion

Some of the practical applications of gypsum cement in the pattern industry have been shown. It is not

possible to cover all applications but only to give the patternmaker an insight into what type of work may be handled with gypsum cement. By utilizing his ingenuity, the craftsman will develop many more practical applications for gypsum cement during the course of his work.

Attention is called to the fact that

in all the examples full advantage has been taken of the "period of plasticity." No "boxing in" is required when this "period of plasticity" is fully utilized, thus saving much time and effort. A knowledge of the gypsum cement characteristics enables the craftsman to concentrate his efforts on production.

naces, sand mixers, pouring stations and other equipment which give off smoke or steam. Approximately 65,000 cubic feet of foundry air is constantly exhausted to dispel vapors. The company is proud of its clean and well kept foundry that makes for good working conditions.

The recently completed service building houses the plant hospital, employment department, standards and maintenance departments, carpenter and pattern shops, dressing rooms, cafeteria and engineering department. This building is connected with the foundry by means of a heated tunnel and workers are not subjected to foul weather, either during summer or winter, when going from building to building.

In the employees' dressing room lockers have been eliminated. Instead each worker has his own metal basket which is lowered from the ceiling by pulley. Sweaty clothes are aired and dried thoroughly, as the air is changed seven times per hour in the wash room.

The cafeteria also is part of the modernization program, providing food at low cost for employer and employees alike. At one end of the lunch room is a board containing names and photographs of the 121 men and women who are members of the Twenty-Year Club.

## BELLE CITY Opens Doors for

## Racine Visitors

IT WAS "open house" day for Belle City Malleable Iron Co. and its steel division, Racine Steel Castings Co., both of Racine, Wis., on Saturday, November 30. Between five and six thousand people—families, relatives and friends of the company's 900 employees, as well as other persons—toured this modern foundry establishment.

Furthering the premise that "the foundry is a good place to work," Belle City Malleable has inaugurated a modernization and mechanization program. All new improvements were on display as the crowd watched coremakers, molders and melters fashion castings from gray iron, malleable iron and steel.

The roped-off aisles and areas were packed from the starting point, which was the main office building, to the large new cafeteria, where refreshments were served to many a weary walker. Along the route were placed placards which identified each machine and which also contained pertinent facts and figures dealing with production rates and other informative

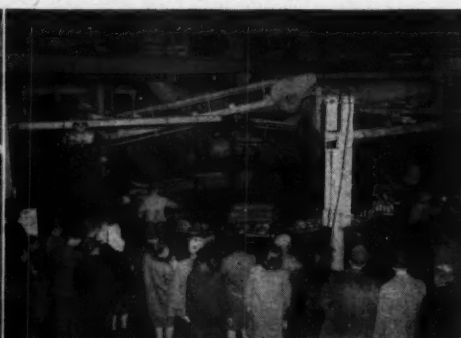
data. Through a number of castings exhibits, which were placed along the way, it was made quite clear that this company's castings help build railroad, agricultural, road building, automotive and industrial equipment.

The newly installed conveyor lines, which take cores on racks from the coremakers' benches and core blowing machines through baking oven and cooling tunnels to the assembly floor, were of interest.

Both the "hopper line" and the "slinger line" were in operation; young and old gazed in extreme fascination at the workings and goings-on which went into the making of a mold.

Huge power driven exhausts are mounted over steel melting fur-

*Belle City Malleable Iron Co., Racine, Wis., held an "open house" recently and below are pictures of the crowd enjoying their visit. Top row (left)—Entrance to main office where "open house" route started. Center—Malleable plant "slinger line" in action. Right—Pouring molds made on the "slinger line." Bottom row (left)—Truck exhibit showing steel castings (on floor) that are used in trucks manufacture. Center—A sectional mold display that proved very interesting and informative to the average person visiting the "open house." Right—Charging an electric furnace in the steel foundry.*



# FOUNDRY COSTS

## REDUCTION AND CONTROL

**C. E. Westover**  
Westover Engineers  
Milwaukee

AMONG MEN of the foundry industry, no subject is receiving greater attention today than the reduction and control of costs. The subject is not new, but is timely. Efficient use of resources, plant, and labor is always of great importance, but at this particular time attention to efficiency is imperative to successful reconversion from a period of operations under a seller's market, with attendant noncompetitive practices, to that of operating under a buyer's market and with keen competition.

The slowness with which many plants are getting into full-scale production of peacetime products is not only depriving consumers of goods and services, but can be one of the greatest contributors to runaway inflation. Low individual productivity, strikes, waste of plant capacity due to lack of materials or parts are all contributors to a manufacturing and operating problem. The whole problem has been further complicated by a 20 to 30 per cent increase in base wages and continued regulated selling prices. Now that price controls affecting foundry products have been lifted, the industry should not delude itself that this is the solution to all its problems.

### Industry's Objective

The main objective of American industry has been to make a better product at a lower cost. Only ever-increasing productivity per manhour

will enable industry to maintain or reduce selling price, improve quality and pay the higher wages.

If it is to gain its objective, industry must use its manpower more effectively than ever before. It is believed that if all branches of the foundry industry could but use the best management methods available, they would attain a level of productivity undreamed of by most foundrymen.

Unless high wages are accompanied by high output, costs and selling prices of castings will be too high to encourage their use as a structural material, or to provide the volume of business necessary to use a fair amount of foundry capacities.

### Methods Advance

Great advances have been made in management methods and techniques in recent years. It behooves every organization to understand and practice these better methods. How, then, may management discharge its obligation to achieve maximum efficiency? This means reduce and control costs. There is no formula capable of general application, but a management seeking to appraise or study its cost reducing opportunities might well consider these questions: (1) In this company,

What cost factors are significant, and which of these factors are controllable? When the foundry operator has determined his cost structure in the light of these questions, he is well on the road to cost reduction and control.

what cost factors are the significant ones? (2) Which of the significant cost factors are controllable?

The first of these questions deals with separation of the more significant from the less significant cost factors, so that the main attention of management can be directed toward those problems whose critical appraisal would yield the largest return.

The second question suggests that assurance of savings depends upon controls. Every foundry operator has a reasonably good idea of the breakdown of his cost dollar. Ordinarily, the significance of each element of cost will be best reflected by relative rather than absolute amounts. There can be but little question that labor is the important cost factor in the foundry industry, as it uses 30 to 50 per cent or more of the cost dollar. This variation is due to the type and kind of casting, and to the producing unit.

### Variable Cost Factors

Labor is also the greatest variable of all the cost factors, particularly in the production of commercial and miscellaneous short-run orders of castings. Obviously, all phases of costs cannot be covered in a short article; therefore, attention will be given to labor costs.

Are labor costs controllable—what steps can be taken to control and reduce labor costs? There are three important steps which can be taken in the direction of controlling and reducing labor costs. Reducing costs means the elimination of waste in labor efficiency.

STEP NO. 1: A good organization structure should be set up, one which

stresses the clear delineation of responsibilities and the assignment of commensurate authorities. Only thus can the groundwork be laid for executives to make needed changes in rigid, tradition-bound practices to eliminate waste.

There is no substitute for placing in each key position the individual whose ability and training match its requirements. Such an executive, with an observant eye for waste and the determination to eliminate it, constitutes the first step toward cost control.

**STEP No. 2:** The reduction and control of labor cost requires the establishment of a reasonably accurate measure of work performance. To do this, it becomes necessary to first establish standards of operations, namely, standardization of materials, methods, and quality in order that the operators may be consistent in performing the required work.

#### Time Standards

Having established standards of operation, the cost executive is then ready to set time standards of performance for operators. And, if a really good job of setting time standards is to be done, the time study results must be built into standard data. Standard data mean element time and not over-all time. Unfortunately, too few foundrymen have a true understanding of time studied standard data.

If labor costs are to be controlled, regardless of whether operators are working for an hourly wage or under a wage incentive plan, it is necessary to know the time required to do a given piece of work. The same methods of establishing time standards should be employed for either hourly or incentive work.

However, in the case of hourly workers, there is no assurance of attaining standard production. To achieve a schedule of planned output from the worker the aid of a wage incentive plan will be necessary. Wage incentive plans based on sound principles and strictly adhered to by management will become increasingly important with the return to competitive business. Time is a stable measure, and with time the effectiveness of methods and materials as well as the performance of operators can be measured.

**STEP No. 3:** Development of a

sound basic wage structure is essential in the reduction and control of labor costs. After good time measured standards have been developed for either hourly or incentive workers, it then becomes necessary to translate or convert standards into earnings or wages. Wages are the product of a time measure and a money conversion figure. What, then, is the conversion figure?

To obtain this figure it is necessary to turn to occupational or job evaluation, which in turn provides an orderly and logical method of establishing the relative value of each and every job in the foundry for both the skill required and the monetary value. It also establishes the basic value of the characteristics which an employee must possess in order to meet the requirements of the job.

As a result of this evaluation a graph or chart will be developed, from which the conversion rate for hours or incentive time standards can be ascertained.

In a discussion of cost controls, some thought should be given to production. There are two kinds of production affecting costs—total production, i. e., volume of business, and individual production. Since we are discussing labor costs, our concern is only with individual productivity. It is obvious that individual productivity must be maintained on a high level if full-scale production on a basis profitable to both labor and industry is to be achieved in the buyer's market we are now entering.

#### Can You Help?

A.F.A. is anxious to obtain some copies of A.F.A. TRANSACTIONS, Volume 52 (1944) from members who may have no use for copies in their files. The supply of this volume is entirely exhausted and a number of important requests have been received for this edition.

For intact copies in good condition A.F.A. will be glad to make arrangements for purchase. If you have a copy of Volume 52 which you do not need, please forward promptly to: The Secretary, American Foundrymen's Ass'n, 222 West Adams Street, Chicago 6, Ill.

## 1947 Competition Opens In Apprentice Contest

INDENTURED APPRENTICES have an opportunity to test their skill and imagination in the A.F.A. Annual Apprentice Contest, sponsored by the Apprentice Contest Subcommittee, A.F.A. Educational Division, and now open for 1947. Competition is open to any indentured apprentice, not over 24 years of age, on the North American continent; and this year, will be for greatly increased prize money, 100, 50 and 25 dollars in each of the four contest divisions, patternmaking and gray iron, steel and non-ferrous molding.

The age limit, in the case of ex-servicemen, is 24 years plus the term of service. Apprentices are not required to be A.F.A. members, nor employed in an A.F.A. member plant.

Regulations of the A.F.A. Annual Apprentice Contest provide for preliminary contests to be conducted locally, by chapters or several foundries, to select entries for the final competition. A special type of preliminary contest, conducted by Eastern Canada and Newfoundland A.F.A. chapter, is described elsewhere in this issue.\* Apprentices from areas in which such local contests are not held, enter their castings or patterns directly in the final competition.

Complete contest details and regulations, recently revised by the Apprentice Contest Subcommittee, may be obtained from the American Foundrymen's Association, 222 W. Adams St., Chicago 6.

Chairman of the Apprentice Contest Subcommittee is E. W. Pierie, Motor Pattern Co., Cleveland. Other members are: J. G. Goldie, M. B. M. Foundry, Inc., Cleveland; E. P. Meyer, Chain Belt Co., Milwaukee; C. W. Morissette, Pennsylvania State College, State College, Pa.; P. M. Sanders, metallurgical consultant, Detroit; R. W. Schroeder, Washburne Trade School, Chicago; Wayne Stettbacher, Employers Association of Detroit; G. Ewing Tait, Dominion Engineering Works, Ltd., Montreal, Quebec, and G. A. Zabel, Universal Foundry Co., Oshkosh, Wis.

\*See Page 59.

# MOLDING SAND

## BRASS AND BRONZE

L. B. Osborn  
Houghland & Hardy  
Evansville, Ind.

EFFORTS HAVE BEEN MADE in recent years to duplicate, synthetically, some of the widely known natural sands of repute in non-ferrous foundries. French sand from Normandy is a notable example. Although it is possible on paper to duplicate, from the sands of the Middle West or combinations of Eastern sands, specifications that resemble the famed French sand, few practical foundrymen will agree that actual casting results are equal.

In discussing French sand both older and younger molders almost invariably refer to it as a very fine sand, as if it were a 0 or 00 instead of a No. 2 in the A.F.A. classification (149 average fineness after being ground). The strength of the bond is baffling, especially when it has such flowability that the fairly coarse grains adjust themselves under pressure to produce a smooth casting surface. The sand and bond combination also holds moisture exceedingly long. French sand is an example of a natural product with quality performance that has been acknowledged around the world, and few foundrymen will admit that modern sand science can duplicate it.

Synthetic sands have their adherents, but even the largest brass and bronze foundries are, in general, continuing with natural sands with their merits of easy control, easy patching of molds, good casting fin-

ish, prevention of dried and broken edges of molds, elimination of excessive ramming pressures and other detrimental factors that go hand in hand with synthetic sand.

*Correlation of Laboratory Work with Foundry Results.* During the past ten years of sand research, much effort has been made to find the rhyme and reason for foundry troubles. Many special visits have been made on invitation from different foundries which were experiencing casting troubles. Other visits were at routine intervals, checking results

▶ **Surveying molding sands for the non-ferrous industries, natural bonded sands continue to be the popular choice for both large and small foundries. Postwar casting production focuses greater attention upon casting finish and the economies necessary in obtaining finish under competitive conditions. Molding and core sands themselves assume a greater responsibility to this end, with many foundries seeking to reduce the use of mold coatings, special facings and other procedures that may have been more profitable under wartime systems of operation. For operating efficiency and simplification, it is advisable to have the whole heap or the entire system equivalent to facing sands; and the fine texture and favorable workability of many natural sands makes this conveniently possible for most foundries.**

and gaining information of mutual interest. In many instances, sand analyses were made during periods of trouble and again at a later date when better casting results were known to be in effect. As much as we would like to believe that definite results could always be shown by analytical methods, such is not the case. Frequently, only a slight change of permeability, clay content, strength or moisture could be found after the troubles had been eliminated.

These instances were noted especially in foundries where no central sand conditioning equipment is used. In some foundries laboratory results did not confirm the extensive change of results that actually took place in the foundry. Part of this condition probably is due to metal or molding factors other than sand conditions.

A number of the medium and small size foundries undertaking drastic sand changes experienced severe trouble. For example, in such cases where a change of permeability was attempted from, let us say, 8 to 30, the results sometimes were bad, especially in foundries where the individual skill of the molder largely determines the outcome.

In one foundry operating a continuous system, a study of sand conditions was made during a period of abnormally high losses, and again 5 weeks later after large new sand additions had been made, with a resultant large increase of natural clay content. In this plant a 7 to 8 psi. green compressive strength was found to be most efficient. During a period when the consumption of new sand had been cut off almost entirely, the bond strength was regulated by synthetic additions. After

resuming additions of natural sand, the workability of the sand improved and it was no longer extremely critical to moisture content. Cracked molds and damaged edges due to drying out of sand and rough mold handling were eliminated. A complete analysis of this system sand at these two stages of operation is given in Table 1.

**Relationship of Dry Strengths.** Brass and bronze foundries using natural sands often have difficulties because of inadequate dry strength. A range of from 25 to 75 psi. usually is suitable, but some of the natural sands that have been so extensively used in the past have lower dry strengths and need reinforcement.

Many sands produced in the belt from southern Ohio to southeastern Kansas have dry strengths within these desirable ranges. The tendency in the plants where dry strength is inadequate is to spray the molds or use special shake-ons and facings. In some cases portland cement is used as a shake-on to increase dry strength. However, such remedies can often be eliminated by proper sand selection in the first place. Most foundrymen will agree that water is one of the necessary evils in a foundry, yet it is one of the molders' favorite working materials. Moisture of heaps on the floor is difficult to control, and influences other sand

properties of permeability, green and dry strength, hot strength, retained strength, etc. Most foundries using well selected natural sands obtain good results regardless of large moisture variations in heap sand. The superintendent of a good brass and bronze foundry frankly admitted that the heaps vary from 6 to 10.5 per cent moisture.

**Relationship of Permeability.** The subject of sand permeability has had widespread discussion and study. It was one of the first sand properties to be brought into open discussion and it continues to interest non-ferrous as well as other foundrymen, technicians, and metallurgists. During the past 15 years the tendency has been to increase the permeability of sands for non-ferrous practice. Recently, however, some leveling off in this program has been noticed and, occasionally, some reversals.

#### High Lead Bronzes

The finer sands of low permeability have a great advantage over other sands, natural or synthetic, for high-lead bronzes. H. W. Dietert and his associates have presented interesting information on permeability and back pressure in the mold, and many foundrymen in the course of actual production have learned that there is a limit to the advantages of permeability and that moderation is sometimes the best policy.

A relationship between permeability and the texture and working properties of molding sand exists which undoubtedly accounts for the popularity of natural bonded sands for non-ferrous castings. The typical brass and bronze foundry usually obtains good production and sound castings within the range of 10 to 50 permeability, and 7 to 25 permeability for average aluminum castings. One thing should be remembered, however, and that is that no certain specifications can be set up for successful operation in every foundry.

However, the permeability ranges just mentioned are in wide use in both average size and larger foundries. In some cases the permeability may have to be kept as much as two to three times the maximum previously mentioned; nevertheless, by avoiding unreasonably high permeability better sand handling conditions and casting finish are obtained and, at least where hand molding is

concerned, the molder usually is much happier when his sand is not too coarse and open.

**Relationship of Green Strength.** Green strength should be ample to provide flexible molding conditions, fast production with a minimum of gagging, nailing, and patching. Light to medium weight bronze castings usually are produced efficiently in heap sand ranging from 6 to 9 psi. green compressive strength. Sands having either natural or artificial bond and which are too sticky or too colloidal usually lack flowability and result in poor casting finish. The tendency of highly colloidal clay bonded sands to dry rapidly often causes difficulty in mold patching.

This is one of the serious handicaps of synthetically bonded non-ferrous sands, and some natural bonded sands are more objectionable in this respect than others. It is also desirable to have a relatively low strength per unit of clay in order that a heap clay content may be maintained at about 10 to 16 per cent clay for brass and bronze, or 8 to 12 per cent clay for aluminum castings. This extra clay provides padding and filler between the grains, giving greater moisture tolerance, better casting finish, and reduced thermal expansion to protect against seams, streaks, buckles, and other difficulties caused by sand movement under change of temperature.

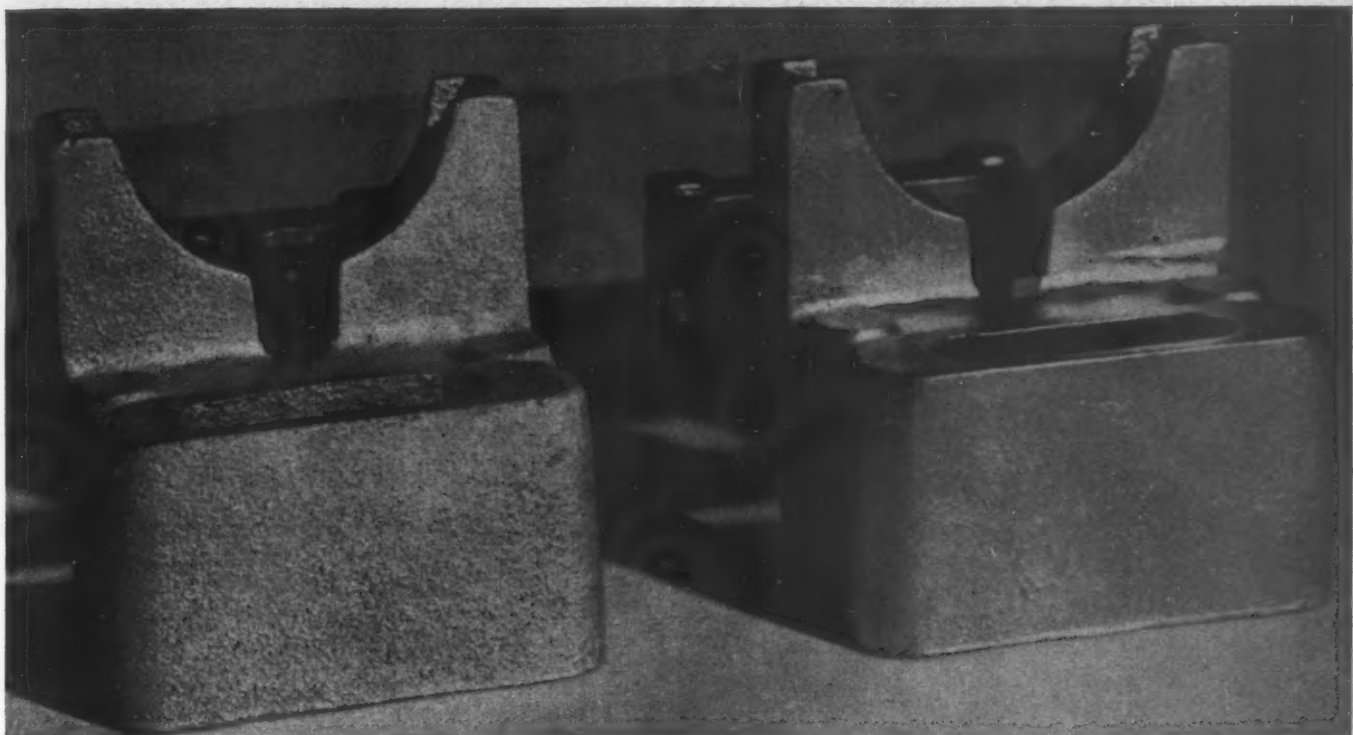
#### Sintering Point Range

**Relationship of Sintering Point.** The sintering point of sands for non-ferrous castings, with the exception of nickel-silver and monel metal, may be much lower than that of sands for ferrous castings. Sands having "B" sintering points from 2100 to 2350° F. usually are considered adequate for brass, bronze, and aluminum. This range embraces sands from New York state as well as several Midwestern states.

A number of foundries have attempted to improve casting finish by switching to higher sintering sands for non-ferrous metals. The result sometimes has been an increase in mechanical penetration, veining, fencing and other such difficulties peculiar to the brass and bronze castings. This unsuitability is not due entirely to the sintering point but has a relationship to flowability, hot

**Table 1**  
**ANALYSIS OF SYSTEM SAND**

Properties	Additions	
	Synthetic Sand	Natural Sand
Moisture, per cent	6.8	7.6
Permeability	11.4	18.4
Green shear, psi.	1.7	1.9
Green compression, psi.	7.6	7.8
Dry shear, psi.	18.0	21.0
Dry compression, psi	85.0	93.5
Retained on Mesh, per cent		
12	1.40	—
20	0.80	2.60
30	0.80	0.40
40	1.40	1.60
50	4.20	4.00
70	13.40	12.80
100	16.20	20.20
140	14.60	13.20
200	21.20	12.20
270	2.80	4.20
Pan	20.00	15.60
Total Screen	96.80	86.80
Clay	3.20	13.20
Deformation	0.012	0.018
Tensile	3.7	4.2



*Fig. 1—Aluminum castings made in sand with sands having permeabilities (left) of 20 and (right) 7.*

strength, and sand expansion and contraction. In many instances, the higher sintering sands of synthetic composition and a few natural bonded sands are deficient in flowability and have too much hot strength in the temperature ranges from 1000 to 2000° F., which is a handicap of such sands.

Also, the clay content of high sintering sands is more colloidal and less flowable, and this is partly responsible for the failure of high sintering sands to give as good non-ferrous casting finish as lower sintering sands under the same conditions of ramming, tempering, grain size, and permeability. From the point of view of refractoriness, it does not seem worth while to take a sand that is suitable, let us say, for producing steel castings and to pour metal in it at only one-half to three-fourths of the temperatures used in steel foundries.

**Relationship of Hot Strength.** Years of experimentation on hot strengths of various sands, domestic and foreign, brings out the fact that this feature is important in brass and bronze molding sands. Inadequate hot strength often is responsible for fins and a wrinkled surface. Careful attention must be given to the type of sand used, its hot strength characteristics, and its tempering and ramming, in order to minimize this

defect. Additions of silica flour, iron oxide, fly ash, cereal binder, bentonite, and other fillers and binders have been experimented with in an effort to overcome this annoying defect. It sometimes happens that a sand, which in a dilatometer shows cracks and spalling, nevertheless gives satisfactory performance in the foundry. Many foundry supervisors and molders automatically compensate for sand deficiencies without knowing why or how they do it.

#### Controlled Conditions

For example, one of the popular sands which has an abnormally low hot strength and rapid rate of contraction which is conducive to sand spalling and cracking does, under carefully controlled conditions, perform satisfactorily. Such a sand must be worked at a higher temper than other sands which have better high temperature stability. The low hot strength sands are worked with as much as 10 to 12 per cent moisture content in order to achieve sufficient hot strength and retard collapse. Such excess moisture frequently results in other troubles, pinholes, blows, etc., resulting in rejection of castings before or after machining.

Some foundries have successfully achieved a desirable balance by blending sands to obtain the correct medium hot strength and thus get satisfactory results for brass and

bronze castings. The lower hot strengths are more satisfactory for aluminum. Many sands, natural and synthetic, have too much hot strength at 1000° F. for good aluminum performance.

Non-ferrous foundrymen have been puzzled by the different degrees of sand adhesion or penetration in comparing one sand with another. Some concluded that chemical reaction during the casting process is the prime cause. On the contrary, recent experiments by W. M. Ball, Jr.,\* give evidence that the penetration and wrinkled surface defects are physical and mechanical. Analysis of the metal comprising the wrinkled surface has been found to be the same as that of the casting proper. This is further evidence that penetration is principally a physical reaction, and the variations in ramming inevitable under hand molding conditions bring about greater penetration difficulties.

Low bonded, flowable sands capable of carrying rather high temper contents often have been observed to be effective under such conditions. The extra water content creates back pressure as well as chilling the metal

\*Magnus Brass Div. of National Lead Co., Cincinnati.

**Table 2**  
**ANALYSES OF NATURAL SANDS**

Properties	Sand No. 1	Sand No. 2
Moisture, per cent	7.0	7.0
Permeability	18.4	49.0
Green shear, psi.	1.8	2.7
Green compression, psi.	6.9	11.2
Dry shear, psi.	3.0	5.1
Dry compression, psi.	22.0	29.0
Retained on Mesh, per cent		
30	—	0.60
40	0.80	0.60
50	0.60	0.80
70	1.00	7.80
100	6.60	40.60
140	28.60	26.20
200	40.00	4.40
270	3.40	0.60
Pan	2.20	0.40
Total Screen	83.20	82.00
Clay	16.80	18.00
"B" Sintering Point, °F.	2606	2651
Deformation	0.016	0.014
Tensile	6.8	9.8
A.F.A. Av. Grain Fineness	125	82

and inhibits penetration. Recently, in foundries that are more highly mechanized and where sand is rammed to a more uniform density, the appearance of the penetration defect is less frequent.

**Advantages of Synthetic Sand.** Synthetic sands appeal to foundrymen who want open and permeable sands. The choice of fine grades of bank sands or silicas suitable for brass, bronze, and aluminum castings is relatively limited. Nevertheless, some foundries have insisted on synthetic sands largely for the purpose of maintaining high permeability. This was true during the war

by the makers of some aluminum castings and in other war work.

Some aluminum foundries insisted, rightly or wrongly, on a permeability as high as 100, and conventional molding sands ordinarily used in non-ferrous foundries do not cover this range. Therefore, non-ferrous synthetic sands usually are made from the higher priced washed and dried silicas. However, the bonding materials used often have excessive hot strength in the temperature ranges between 1000 and 2000° F., resulting in cracked castings, leakage, seams and buckles, and other difficulties.

Full synthetic sands are also tricky to control and are critical to slight changes of moisture. It is well known that where such sands may work satisfactorily with 4 per cent of moisture, they are not at all satisfactory at 3 or 5 per cent. Rapid drying out of the molds is also experienced under these conditions.

Various expedients have been used to prevent this annoyance, such as chemical additions, oil or cereal binder, and additions of natural sand to synthetic, none of which are as dependable as the proper natural sands would be. Some natural sands have the peaked grain distribution and high permeability which characterizes synthetic sand, and at the same time have clay bond that is not critical to reasonable variations of moisture. The analyses shown in Table 2 indicate two such sands that have a marked resemblance to synthetic sand, and yet are entirely natural sands and with clay bond characteristics capable of satisfactory performance over a moisture range

of 5 to 11 per cent. These sands are also suitable for foundries which wish to pursue a semi-synthetic program where natural bonded sand is used with only occasional additions of re-bonding material to conserve and prolong the use of sand.

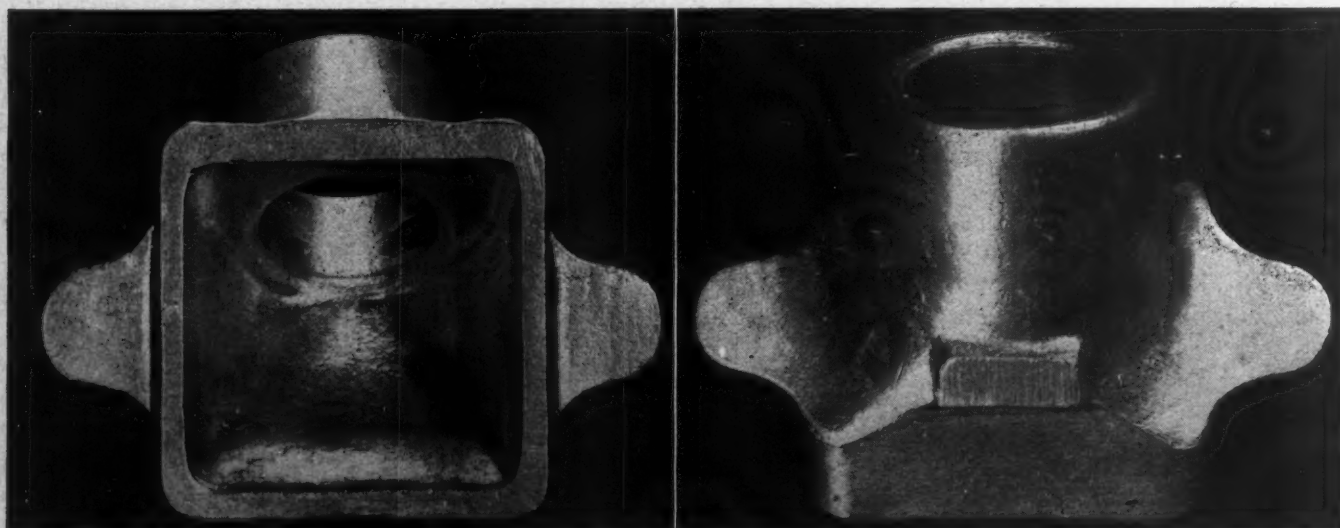
### Metal Penetration

Too often foundrymen speak loosely of burn-on or metal penetration as if the conditions were due to inadequate refractoriness of the sand, whereas the true cause often is due to inadequate flowability, causing voids to be left in the mold surface which are open for metal penetration during the casting process. The highly colloidal bond used in synthetic sands is, under practical conditions, likely to impair flowability, bringing about penetration and sand-paper finish, especially in making the bronzes that have an inherent or persistent tendency to flow in between the sand grains.

For this reason, it is necessary to have fairly high permeability and high flowability, permitting hard ramming, or to have a soft bonded sand of sufficiently fine texture, in which case medium ramming usually is used. Following the latter policy, many foundries like the so-called No. 1½ and No. 2 Eastern sands or the soft textured Middle Western sands of 10 to 40 permeability range.

Suitable grain size and good flowability are quite essential in producing smooth surface aluminum castings. Figure 1 (left) shows an alumi-

*Fig. 2—Casting made in a high clay content, extremely fine molding sand.*



num casting made in a sand of 20 permeability, 7 psi. green compressive strength and 7.5 per cent moisture. Figure 1 (right) shows the same casting made in heap sand of 7 permeability, 6 psi. green compressive strength and 7.5 per cent moisture. The sand for the latter casting is not only finer in texture but is more flowable. Figure 2 shows a casting made in a high clay content, extremely fine molding sand.

The new sand has 270 average fineness and 20 per cent clay content. The heap sand tests 6.5 permeability, 7.5 psi. green compressive strength and 8.5 per cent moisture content. The green sand core and the mold were made of the same sand.

## DISCUSSION

*Chairman:* B. A. MILLER, Baldwin Locomotive Works, Cramp Brass & Iron Foundries Division, Philadelphia.

*Co-Chairman:* C. LOUIS LANE, Florence Pipe Foundry Co., Florence, N. J.

H. M. ST. JOHN and N. A. TODOROFF<sup>1</sup> (*written discussion*): Natural bonded sands and synthetic sands occupy different but overlapping fields; neither type of sand can be considered universal. In his enthusiasm for the natural sands Mr. Osborn has perhaps failed to do complete justice to the synthetic type.

Natural bonded sands are easier to work and find greater use in small foundries that cannot economically use expensive sand handling equipment. Synthetic sands are more difficult to work and control; they find their application in high-production foundries which can profitably use elaborate mixing equipment. There are many borderline cases.

Mr. Osborn states that brass and bronze foundries obtain good results with sands having a permeability of from 10 to 50. This seems much too wide a range if we are considering only naturally bonded sands. At the lower permeabilities difficulty will be experienced with blows, scabs, pinholes, rat tails and gas seams; at permeabilities near 50 a good finish can hardly be expected if a natural sand without additions is used.

H. W. Dietert and his associates have shown (*Mold Surface Gas Pressure*, A.F.A. TRANSACTIONS 1944) that permeability measurements must be correlated with the amount of steam and gas generated when molten metal is poured into the mold. The amount of gas generated may be so great that the mold permeability is zero in the early stage of pouring.

Water is the principal source of mold gas and the moisture content of the sand cannot safely be permitted to wander widely no matter what type of sand is used. Nor can the chilling effect of high moisture be ignored, particularly when pouring castings of thin section.

<sup>1</sup>Crane Co., Chicago, Ill.

Moisture control is probably the most important single factor in maintaining the desired properties of a molding sand, whether natural or synthetic. The fact that some natural sands can be used at a moisture content as high as 10 or 11 per cent is hardly an advantage if the results of doing so are undesirable.

It is true that certain fine natural sands have no equal if an exceptionally smooth skin finish is desired on small castings. It is also true that, for small castings which are to be polished and plated, a smooth skin finish is of no importance and that these require a high permeability sand of low moisture content if gas porosity is to be avoided.

Poor workability is perhaps the most serious disadvantage of synthetic sands. Intensive mixing and mulling are essential if they are to be used successfully. If the foundry is provided with the proper mechanical equipment for this purpose, the problem need not be a troublesome one.

Synthetic sand molds are more difficult to patch, but their green strength is so high that little patching is necessary. Dry and broken edges can largely be avoided if the proper bond is selected. Synthetic sands admittedly must be controlled more closely than natural sands, but fortunately they lend themselves to control much more readily than do the natural sands.

The foundryman will do well to choose his sand as carefully as he does his metal and to plan his control procedure with equal care. Whether the sand is natural or synthetic (and each has its place) the best possible results will not be obtained without both good sand and good practice.

MR. OSBORN: It is true that my enthusiasm for natural sands is perhaps quite strong. We have to admit that synthetic sands do have considerable value, especially where they are properly used. However, we feel that the natural sands, when they are given the proper selection and given the careful attention synthetic sands must be given, will then perform quite efficiently for brass and bronze castings.

In other words, we feel that natural sands have really a greater place for the non-ferrous metals than they may have for some of the other metals poured at the higher temperatures. The permeability does not have to be so high for natural sands and it is not necessary to watch so closely the chemical purity and the sintering point of the sands as it would be in some other foundry operation.

As to the comment about the permeability range from 10 to 50 being too wide, it is rather wide as a general statement. For the general foundry operating sand in the heaps and hand-ramming or machine-ramming it under average conditions, there are many foundries today that are operating on 10 permeability and having sound castings. I would prefer to see approximately 15 to 20 permeability for most bench work but many foundries are working much lower than that.

As for 50 permeability being too high

for satisfactory finish in natural sand, I do not agree with the author of that statement. There are a number of natural sands that will give a satisfactory finish at 50 permeability. I am thinking of a foundry that does a great deal of aluminum-bronze work and they discarded synthetic sand in favor of natural sand of about 90 permeability, which they work in the heaps. After the breakdown of sand in the heaps, they work the heaps at about a 60 or 70 permeability and get what they consider a good finish, in fact, a better finish than they were getting with synthetic sands.

W. M. BALL, JR.<sup>2</sup>: This sand question is a broad question but I still think it has to be discussed in conjunction with what you are going to pour against it. In this non-ferrous group we have probably two or three thousand alloys and two or three thousand conditions and when you try to buy one sand to match those two or three thousand conditions, you are in a quandary.

The variance of the alloy is going to determine the kind of sand to be used and that is where you get into much trouble. The foundryman who is trying to find a sand that is going to cover all these conditions in a brass foundry is asking for the impossible. He might as well make up his mind that he is going to have trouble trying to seek the condition that will fit the thing that he is trying to do.

If he is changing these alloys, he has to think of a sand for each type of work. That is what we try to do. Sometimes we use a rough sand and the next time we have to use a fine sand. You have to get that skin closed up. I have seen the metal go clear through the core. So if you have that condition, you have to get down to that fineness of sand, or the metal will go through it. You have to change the condition of the sand to suit the material that you are going to pour against it.

MR. OSBORN: Mr. Ball's statements I think are very well made and in nearly every foundry except those that are mechanized and with continuous conveying units, I think it is necessary to use two or three different types of sand. When I spoke of the aluminum-bronzes, I referred particularly to that type of metal, that type of casting. That same foundry, however, is also using sand of about 18 permeability for general work and they have an even finer sand for name plates and memorial tablets and other ornamental work.

We must absolutely select the sand for the job. That was another reason why this paper was left rather vague. We do not want to pin ourselves down too closely to any general program, because it is just impossible to do it. It is better to see the foundry's operation, to see what they are doing with the sand, what they expect, what their past experience has been, and take everything into consideration before you make a recommendation as to the type of sand to be used for certain jobs.

CHAIRMAN MILLER: I have discussed

<sup>2</sup>Magnus Brass Div., National Lead Co., Cincinnati.

the term permeability with the steel, gray iron and non-ferrous foundrymen and they all seem to disagree on the word permeability and its application to foundry sand. Mr. Ball put it mildly when he said, we must consider what we are pouring metal against. I think in a few years hence we will have a better knowledge of what permeability means.

H. F. TAYLOR<sup>2</sup>: I would take rather vigorous but good-natured exception to Mr. Ball's statement and turn it around and say that the man who tries to find a different sand for every possible condition that he runs into in the foundry is in for a big disappointment.

We in the Naval Research Laboratory were faced with the problem of finding what we call a universal sand. The reason for that was that in repairing ships at advanced bases, the business of getting a sand for every purpose presented quite a problem in inventory, in shipping, and in procurement. So we tried to find one sand which would serve all these purposes. We compounded this sand and had the molder ram four molds from a single batch of sand. He did not know what would be poured into those molds and we did not know either.

We proceeded to pour aluminum, bronze, cast iron and steel in those four molds that he made up, and they were all excellent castings. To be sure, the aluminum casting was not as smooth as some people would like, but it was a good casting nonetheless, and with a little work in the blending of the sand, not necessarily a mixing of fines, that will give resistance to penetration and smoothness.

It is a blending, the combination of these sand sizes that give this to you, and I am sure that if we took this one base sand and blended it more expertly, we would find that we could get nice-looking, smooth castings. At the Research Laboratory, we used one sand. At the Norfolk Navy Yard they use a single sand for the various methods and I am sure that in time the trend will be towards simplification rather than trying to make the picture more complex.

As to this business of permeability, the permeability of an ingot mold is zero. Yet they make nice, smooth ingots. The reason for that is that you have not put into the mold a lot of things that are going to create gas, and that is the key to a universal sand. Keep your moisture at a minimum, keep your other materials of a nature that will not form a large volume of noxious gases, and when we do know more about this thing, I believe we will be able to simplify the picture.

The natural sands have a place, a good place, in the foundry. I feel we need to know a lot more about them. A fundamental study should be made, more than we have ever made in the past, even more than we have made in the synthetic sands. I feel that one advantage that the synthetic sand has which perhaps the natural sand will have later is that it is a little easier to control at the present time. When it is con-

trolled the same as the synthetic sands and perhaps a new sand facing used regularly, I do not see how you can control the sand that you use over and over. If you used a new sand and natural sand facing and controlled it like you do the synthetic sands, you would have a pretty good deal.

## Cupola Committee Launches Coke Project

INVESTIGATION of the "Quality and Behavior of Cupola Coke" is to be the first research project sponsored by the A.F.A. Cupola Research Committee, that group decided at its November 20 meeting at the Hotel Traymore, Atlantic City, N. J., with Chairman R. G. McElwee, Vanadium Corp. of America, Detroit, presiding.

The project arises naturally out of the first two activities of the committee, preparation of an exhaustive bibliography of all published data on cupola operation, and publication of the HANDBOOK OF CUPOLA OPERATION, which revealed the directions in which further research was felt most desirable.

Establishment of a method for evaluating cupola coke qualities will be the basic purpose of the present study, which will involve the record-

ing of all factors of cupola operation, such as: slag, volume of air, relative humidity, analysis of effluent gases, melting rates, construction of cupola, and any others pertinent to the operation of melting in the cupola.

Coke will be subjected to the following tests: shatter, apparent density, rumble test, cell structure and standard coke analyses. Consideration is being given to utilization of a standard coke, possibly supplied through cooperation with coke producers.

Operations of the investigation on coke quality and behavior will be undertaken at a number of foundries under arrangements with the Cupola Research Committee and will be under the coordination of a research fellow to be employed by the committee. Data accumulated by the fellow will be issued as a quarterly report to the committee, which will then outline subsequent activities.

Observations will be made in the cooperating foundries, utilizing coke of given heredity and carefully sized, and exercising care that data recorded represents observed facts. Statistical analysis of operating data will then be made by the research fellow. Based on initial observations, plans will be made for acquisition of special data and operation records. Laboratory work will be undertaken if indicated by results of field operations.

## Australian Foundryman Praises Work of A.F.A.

FROM THE OTHER SIDE of the world comes the following unsolicited comment on the activities of your Association, contained in a letter from Robert K. Dobbie, manager, Queensland Electric Steel, Ltd., Brisbane, Queensland, Australia:

"I would like to express my admiration and appreciation of the excellent work being done by A.F.A. committeemen for foundrymen all over the world. Association publications are doing much to assist improvement in the foundry work in this country."

A surprising number of A.F.A. publications are being mailed constantly to the 87 members in Australia, as they are all over the world.

AMERICAN FOUNDRYMAN

### Future

#### Conventions and Exhibits

Feb. 24-25—Industrial Furnace Manufacturers Assn., Chicago.

March 2-5—American Society of Mechanical Engineers, Spring meeting, Tulsa, Okla.

March 17—American Institute of Mining and Metallurgical Engineers, New York.

March 17-19—Chicago Production Show & Conference, Chicago.

March 22—Pacific Coast District Meeting, American Welding Society, Oakland, Calif.

March 22-27—Western Metals Congress & Exposition, American Society for Metals, Oakland, Calif.

April 14-18—111th National Meeting, American Chemical Society, Atlantic City, N. J.

April 28-May 1—AMERICAN FOUNDRYMAN'S ASSOCIATION, 51st Annual Meeting, Detroit.

May 15-17—Society for Experimental Stress Analysis, Chicago. Regional Conferences

Feb. 13-14—Wisconsin Chapter, Schroeder Hotel, Milwaukee.

Feb. 20-22—Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala.

Feb. 28-March 1—Eastern Canada & Newfoundland Chapter, Royal York Hotel, Toronto, Ont.

<sup>2</sup>Massachusetts Institute of Technology, Cambridge, Mass.

# CHAPTER CONTEST

## Determines Apprentice Contestants

ENTRANTS in the A.F.A. Annual Apprentice Contest from the Eastern Canada and Newfoundland A.F.A. chapter area, are chosen through a local contest held by the chapter in co-operation with the Montreal Technical School and foundry and patternmaking shops of the vicinity. To this preliminary competition method of selecting apprentices to pit their skill and imagination against others from throughout the North American continent is attributed much of the credit for the fine showing made by boys from the chapter area: four winners in the 1945 Apprentice Contest, five in 1946 (including all three prizes in non-ferrous molding).

### Three-Fold Purpose

Purpose of the local competition is three-fold: It provides a method of selecting the boys most likely to place high in the continent-wide rivalry; and, also, facilitates local efforts in the latter, through minimizing the number of apprentices who must make use of the limited number of patterns available from A.F.A. Headquarters.

Secondly, interest in apprentice training and in A.F.A. is stimulated through awarding prizes to area winners. Finally, supervisors who are brought in as judges, become interested in the work of the boys who will some day take their places

as leaders in the castings industry.

Sixteen foundries and patternshops in and about Montreal participated in the 1946 elimination contest, which was under the supervision of Henry Louette, Warden King, Ltd., Montreal, and current Chapter Chairman, and Armand Dussault, superintendent of shops, Montreal Technical School.

### Annual Competition

The boys compete each year in iron, steel and non-ferrous molding and patternmaking, and are further classified as to second, third and fourth year apprentices. Molding apprentices do not all use the same pattern; but draw lots for those in the store of the Montreal Technical School.

Patternmaking in the 1946 contest was done under the surveillance of N. Prunier and M. Delorme, patternmaking instructors at the technical school, while molding was done under the supervision of E. Coteur and G. Couture who teach foundry practice at the school.

Apprentices competing in the patternmaking preliminaries in 1946 used drawings selected by H. E. Francis, pattern foreman, Jenkins Bros., Ltd., and William Dunn, partners, Western Pattern Works,

Inc. The Montreal Technical School has no facilities for melting steel; therefore, the steel molding contest was held at Longue Pointe plant, Canadian Car and Foundry Co.

The following men acted as judges for the patternmaking division of the 1946 contest: A. Kinna, Dominion Engineering Works; Ed Cyr, Industrial Foundry and Pattern Works; W. D. Dilks, Turcot Works, Canadian Car and Foundry Co. Iron molding judges were N. McGuiggan, Canadian Foundry Supplies, and James Grieve, assistant supervisor, Dominion Engineering Works. The non-ferrous molding judges were A. Jack Moore, superintendent, Montreal Bronze, Ltd., and W. B. Chadwick, president, Aluminum Foundry and Pattern Works, Ltd. Steel castings were judged by I. Stuppel, Northern Foundry, Ltd.

### Can You Help?

In view of a number of recent references, A.F.A. is interested in obtaining for its technical library a copy of the book, *History of the Manufacture of Iron in All Ages*, by James M. Swank, published by the author in 1884.

If you have available a copy of this volume, please write to: The Secretary, American Foundrymen's Association, 222 W. Adams St., Chicago 6.

*Contestants in the patternmaking division of Eastern Canada and Newfoundland A.F.A. chapter's 1946 Apprentice Contest at Montreal Technical School.*



# LECTURE COURSES

## Aid Chapter Educational Plans

FOUNDRY TECHNOLOGY is reaching an ever-widening audience among foundry workers, the public and students, as a result of the activities of A.F.A. chapters—highlighted currently in a number of educational lecture series under sponsorship of chapter educational committees.

Foundry problems and techniques, fundamentals and latest developments, will receive detailed consideration in the 1947 Foundry Lecture Course Series, presented by Chicago A.F.A. chapter at the Peoples Gas Building auditorium and designed for practicing foundrymen, as well as those planning to enter the industry.

Lectures will be illustrated with slides and motion pictures. Talks are presented on alternate Wednesdays, beginning with January 8, and will concern (in order): *What Do We Know About Sand*, by J. B. Caine, Sawbrook Steel Castings Co., Cincinnati; *Patterns*, L. F. Tucker, City Pattern Works, South Bend, Ind.; *Gating and Riser*, a panel session; *Casting Defects*, W. A. Hambley, Falls Manufacturing Co., Menomonee Falls, Wis.; *Centrifugal Casting*, John Perkins, Ford Motor Co. of Canada, Windsor, Ont., and *Sands and Binders*, O. J. Myers, Werner G. Smith Co., Cleveland.

Speakers at the panel session on *Gating and Riser* will be: Malleable Practice, Kenny Smith, Chicago Malleable Castings Co., Chicago; Steel Practice, John Rassenfoss, American Steel Foundries, East Chicago; Non-Ferrous Practice, W. B. George, R. Lavin & Sons, and, Gray Iron Practice, John Woodell, Hansel-Elcock Co., both of Chicago.

Certificates will be awarded to those attending at least five sessions; and another certificate, good for partial dues credit on an application for junior membership in A.F.A.

Oscar Blohm, Triangle Foundry Co., Chicago, is chairman of the chapter lecture course committee; and H. R. Youngkrantz, Apex Smelting Co., Chicago, is secretary.

### First Saginaw Valley Series

Saginaw Valley A.F.A. chapter presents its first series of Educational Lectures this year, on successive

Thursdays from January 9 to January 30, at the auditorium of the Arthur Hill Trade School, Saginaw, Mich. Students will be admitted free, and there will be a nominal fee to others.

The four sessions of the course will be in the form of discussion panels. Subjects and discussion leaders are (chronologically): *Pattern Equipment and Rigging*, Fred Serr, General Foundry & Manufacturing Co., Flint, Mich.; *Cupola Melting Practice*, L. L. Clark, Buick Motor Div., General Motors Corp., Flint; *Molding and Coremaking*, Don Bowman, Almont Manufacturing Co., Imlay City, Mich.; *Cleaning, Grinding and Inspection*, M. C. Godwin, Bostick Foundry Co., Lapeer, Mich.

For the first lecture, *Pattern Equipment and Rigging*, the chapter will have on display the patterns used in the 1946 A.F.A. Annual Apprentice Contest.\* Later, these patterns will be displayed in a number of trade schools throughout the chapter district.

### Central Illinois Concludes Course

Response of young men not in the foundry industry, as well as those already in the field, to the five educational lectures presented at Bradley Hall, Bradley University, Peoria, Ill., during October by Central Illinois A.F.A. chapter, was so enthusiastic that the chapter is planning another series for this spring. The program was elementary in nature, designed to interest new people in the foundry industry.

Chapter Director F. W. Shipley, Caterpillar Tractor Co., Peoria, and program chairman for the chapter, drew up the course and arranged for speakers, together with Dale Wright and Russell Meyers, chapter chairman and educational chairman, respectively, of the Peoria chapter, ASM, which was joint sponsor of the series.

Prof. H. L. Walker, University of Illinois, Urbana, presented the first lecture, on metals and elementary foundry metallurgy; A.F.A. National Director J. E. Kolb, Caterpillar Tractor Co., handled the subject of

\*For review of patterns entered in 1946 A.F.A. Annual Apprentice Contest see pp. 61-64.

patternmaking in a comprehensive manner, from design to completion of the pattern; Alex Barczak, Bardes Forge & Foundry Co., Cincinnati, spoke on *Foundry Molding Practices*, explaining in simple terms sands, equipment, fashioning of the mold and pouring; S. G. Garry, Caterpillar Tractor Co., presented the story of coremaking, and U. S. Sullivan, of the same firm, explained and described *Foundry Inspection and Testing Methods*.

The committee in charge publicized the program through the mailing lists of the chapters of the two sponsoring societies and through notices to factories and high schools within a 50-mile radius. Those attending displayed keen interest in foundry technology and each meeting was highlighted by participation of the audience in the general discussion period.

### New Chapter Committees

With their educational activities in full swing, as indicated above, a number of chapters have announced membership of their new educational committees. A partial list follows:

**Detroit Chapter:** G. L. Galmish, Michigan Malleable Iron Co., chairman; C. H. Hungerman, Cadillac Motor Div., General Motors Corp.; E. V. Ivanso, Steel Sales Corp.; R. W. Mason, Jr., International Nickel Co., Inc.; W. C. Morgan, E. F. Houghton Co., and P. M. Sanders, consulting metallurgist, all of Detroit.

**Chicago:** C. J. Reynolds, Sivyer Steel Casting Co., chairman; F. F. Shoemaker, Armour Research Foundation, and R. W. Schroeder, Washburne Trade School, all of Chicago; Prof. R. G. Bigelow, Northwestern University, Evanston, Ill., G. A. Davis and J. S. Turek, both of Crane Technical High School, Chicago; W. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind., and E. E. Schwantes, International Harvester Co., Chicago.

**Western New York:** J. C. Nagy, Charles C. Kawin Co., Buffalo, chairman; L. A. Merryman, Tonawanda Iron Corp., North Tonawanda; and C. A. Harmon, Hanna Furnace Corp.; H. K. Rose, Swan, Finch Oil Corp., and R. W. Molley, Foundry Metal Sales Co., Inc., all of Buffalo.

# VARIETY FOUND IN 1946 A.F.A. APPRENTICE CONTEST PATTERNS

Frank C. Cech  
Cleveland Trade School  
Cleveland

THE PATTERNS ENTERED in the Pattern Division of the 1946 A.F.A. Annual Apprentice Contest were noteworthy for variations in construction. Each of the 21 patterns submitted in the final contest was different from the others in at least one respect. The considerations to be observed in the contest and the patterns which resulted are de-

scribed and illustrated in this article.

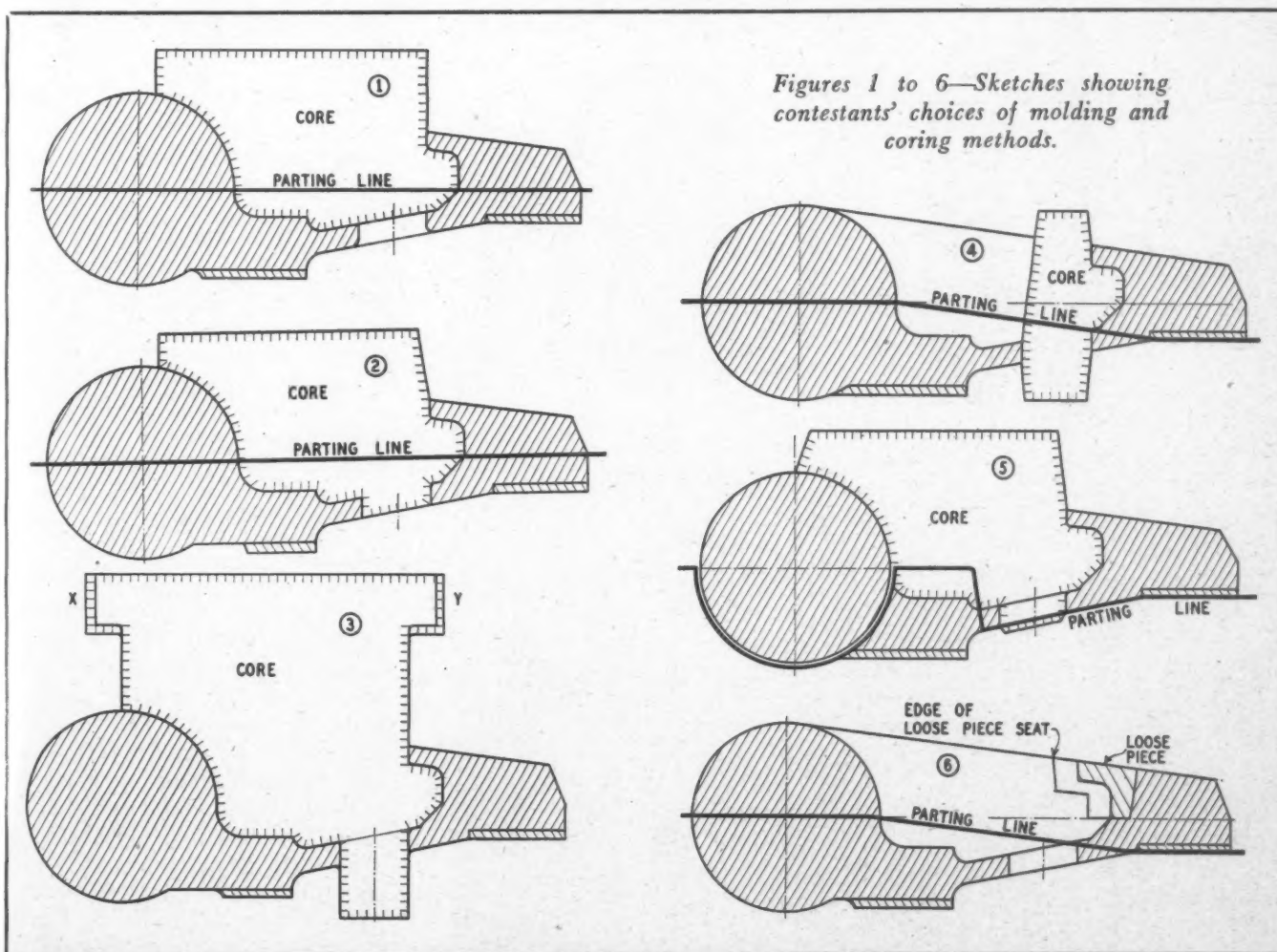
In addition to a valuable discussion for class work and chapter meetings, this description of the 1946 apprentice contest patterns concludes with a number of suggestions and criticisms helpful to entrants in future contests.

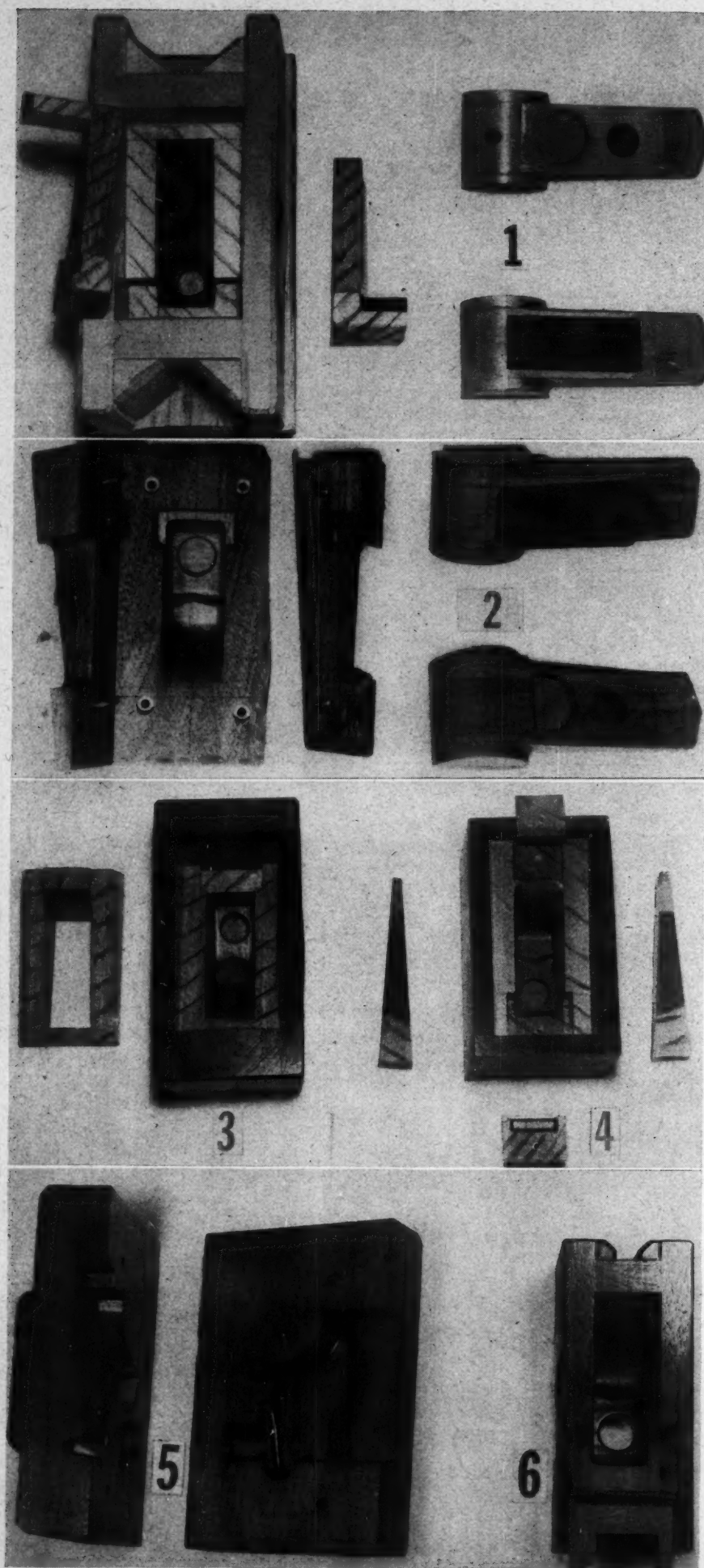
**Blueprint Interpretation.** The first step of an apprentice patternmaker in the contest is to interpret the contest blueprint from the point of view of a checker in an engineering department. He should determine whether the projection of the cast-

ing is in accordance with the drawing room standards. There are instances where the first angle projection has been used, thus confusing the blueprint reader.

Next, a quick check is made to see that all lines necessary to represent the object have been used and that no superfluous lines have been added. The final check is to see that all necessary dimensions are included. At times dimensions seem to be missing, but on close scrutiny a method of layout can be found.

After checking the blueprint, the





patternmaker studies the blueprint for information necessary to construct the pattern. For the most part, the apprentice must rely on his past experience in building pattern equipment and in observing patternmakers at work.

**Molding Choices.** Figures 1 to 6, inclusive, show contestants' choices of molding and coring. Figures 1 and 2 differ only in that one core includes the 1-in. opening, while the other allows green-sanding it. The green sand core permits rounding the corner of this opening, thus adding to the appearance of the casting. While this may seem trivial, such practice improves the appearance and salability of castings in many cases. Both methods are apt to produce fins where the core and green sand meet.

The molding choice represented by Fig. 3 shows the pattern parted at right angles to the parting shown in Figs. 1 and 2. The coreprint shown in Fig. 3 is much longer than necessary when the key seen at X and Y is included. (Compare pattern No. 17 with pattern No. 21.) The 1-in. cored hole will contain no fin because of the coreprint. All three methods (Figs. 1, 2, and 3) are common molding practice.

#### Parting Provisions

Figure 4 and pattern No. 20 show a solid pattern with draft running either way from the parting line. This pattern, and those illustrated in Figs. 5 and 6, necessitates the use of a follow block, similar to the one shown between patterns No. 17, 18, and 19, or a false cope, sand match or a follow board to provide a ready parting for the molder. Otherwise, this molding method becomes time consuming and expensive as well as giving an inaccurate parting. The core serves the double purpose of coring the ledge and the 1-in. opening.

Figure 5 and pattern No. 19 give the impression that consideration was shown for the molder in providing a follow block to produce convenient ramming, a ready parting, plenty of taper on the coreprints and draft on the pattern. However, there is a disadvantage in the narrow pocket that must be coped out. A parting as in Fig. 6 would have prevented this. Note the small button coreprint in use on the 1-in. opening.

The pattern illustrated in Fig. 6 is well adapted to a limited run of

castings. The loose piece shown in Fig. 6 and pattern No. 18 is well seated. This, plus excellent workmanship, results in a serviceable pattern and attractive castings as the green sand core eliminates the fins which may result from the use of dry sand cores.

The coreboxes for patterns No. 1, 2, 3, and 4 are similar only in that all four are dump boxes and have loose pieces. Otherwise, they are constructed differently. The loose-piece frame of corebox No. 4 consists of four separate pieces, the frame of Nos. 1 and 2 is made up of two pieces, and that of No. 3 is one piece. The one-piece frame was favored by the judges because it entails less work and minimizes the number of pieces that may be lost.

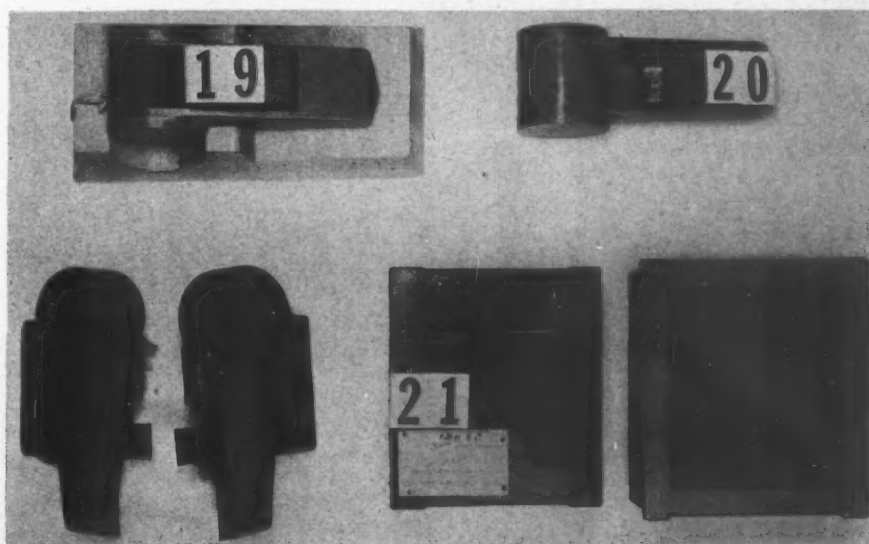
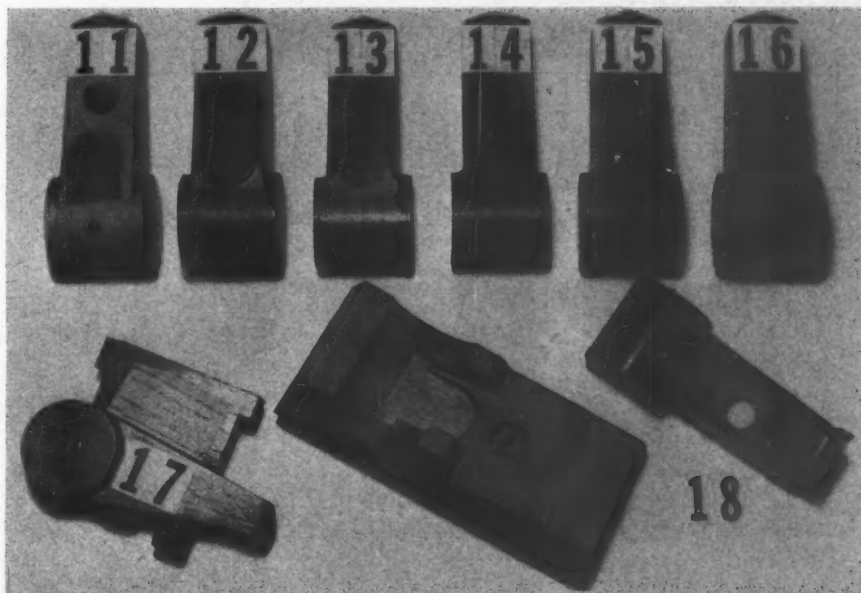
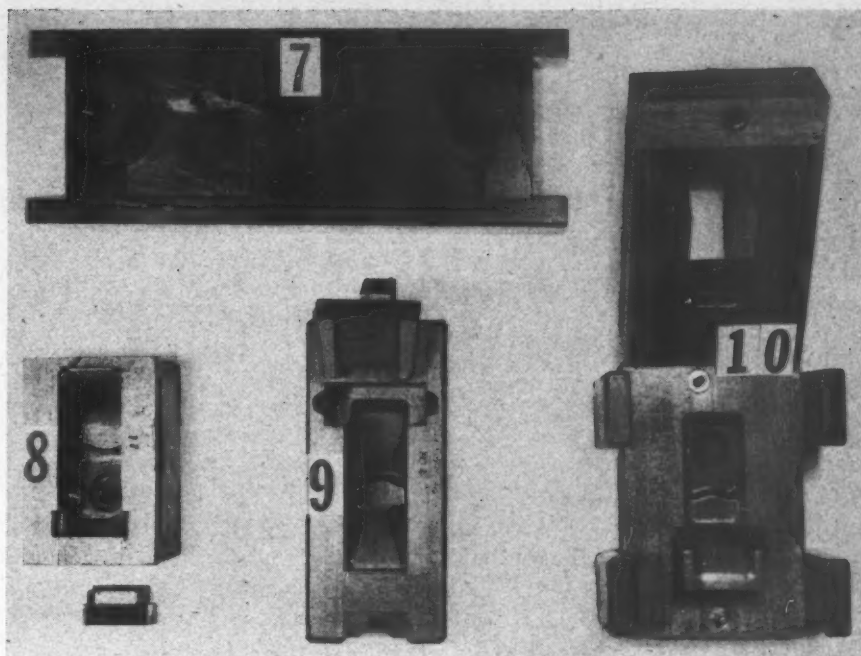
#### Core Drawing

However, it must be drawn from the core first, and only after filling its space with bedding sand can it be rolled over. The other coreboxes are rammed, rolled over, the portion of the box housing the loose pieces is drawn and, finally, the loose pieces are withdrawn from the core. Each of the four coreboxes has merits. Some would object to bedding the core while others would object to the number of loose pieces. Corebox No. 2 would be the easiest to keep clean as it has fewer corners in which the sand is apt to stick.

Corebox No. 5 was well received by the judges. It can be rammed from the top with the box closed, then rolled and drawn apart by the handles, one of which may be seen at the extreme left. The corebox halves can also be rammed separately, booked and drawn.

Corebox No. 6 is a dump box, constructed in the customary manner of the pattern shop and having one loose piece. The 1-in. hole in the bottom is open, thus enabling the coremaker to watch his draw and, in case of a threatened core breakage, a core repair can be effected before completing the drawing of the corebox.

Corebox No. 7 represents a gang corebox of the dump type. Generally, when a box of this type is planned it is solely with the thought of saving time in the ramming and drawing. The planning should also include such features as a small margin of corebox stock separating the



cores and the ease with which it is possible to slide cores close to those already resting on the coreplate. These factors save coreplate space and promote maximum use of baking facilities.

Many jobs, when compared to other similar jobs, present objectionable features which otherwise might be overlooked. As an example, when Nos. 8 and 9 are placed side by side the weakness of construction in corebox No. 8 is readily apparent in the lack of marginal stock allowed outside of the core impression. In contrast, No. 9 appears well constructed and able to withstand repeated mallet blows. Both coreboxes have a loose piece that must be drawn and bedded before dumping.

Simplifying manufacturing operations permits the use of unskilled or semi-skilled instead of skilled help, with a resultant decrease in manufacturing costs. If labor costs remain equal, simplifying operations increases production. Both make for wider distribution of articles produced, thus increasing business. If an apprentice were familiar with these simple laws of economics, he would not construct a corebox such as No. 10. In addition to being a costly method of construction, there is also the chance of rolling a core unsuccessfully.

#### Core Support

It was the consensus of opinion of the contest judges that pattern and corebox No. 21 were well planned with reference to the molding and coring. The coreprint lengths gave good core support. The coreboxes were of the dump type, split and doweled for booking. The bed-in frame, which was furnished to facilitate core drying, raised the question among the judges as to why more pattern shops do not furnish bed-in boxes or frames. The answer was that foundries generally furnish their own and the pattern shops therefore do not include bed-in frames in price quotations.

Probably one of the most controversial aspects of the 1946 pattern-making contest was the shape that the finish pad should take on the tapped boss. Patterns No. 11 to 16, inclusive, illustrate the variance of opinion as to the proper shape of pad. Of these only Nos. 12 and 16 would leave a neat casting free of

offsets. The finish pad should be either round or semicircular.

Following is a summary of criticisms of the patterns entered in the 1946 A.F.A. Annual Apprentice Contest and suggestions made by the judges:

1. Dimensions varied and poor workmanship was shown. The latter included poor rounding of corners; rubbing fillets into place and not preserving the true radius; using butt joints and not nailing them; omitting fillets and round corners, etc.
2. Center lines were missing or not carried over to parting line, thereby making checking of the pattern time consuming and difficult.
3. Loose pieces were not seated properly.
4. Loose pieces were not dove-tailed.
5. Short-grain construction made weak patterns.
6. Drafted sections of pattern did not correspond to the drafted sections of the corebox.
7. Use the customary draft, not too much, but better too much than no draft at all.
8. Too much taper on coreprints makes core setting difficult.
9. Split the corebox across corners where feasible.
10. Split the pattern rather than make a follow block or board.
11. Wood fillets or loose pieces should not have feather edges.
12. Use of fillets wherever possible, even if it becomes necessary to part a piece to get a gluing surface for the fillet.
13. Dump coreboxes must have draft.
14. Witness-marks or tell-tales should be large enough to make a difference in setting a core but not so large that they make molding or core setting difficult.



## Change Firm Name of Foundry Equipment Co.

AMERICAN FOUNDRY EQUIPMENT Co., 38-year-old Mishawaka, Ind., firm, has changed the company title to American Wheelabrator & Equipment Corp., according to announcement of O. A. Pfaff, president. The new name, Mr. Pfaff pointed out, is considered more appropriate because one of the principal products is the "Wheelabrator," developed by the firm and used for cleaning and finishing metal products in many fields.

## Association Publishes New Symposia

TEN TECHNICAL PAPERS, with accompanying discussions, comprising the 1945 and 1946 malleable symposia, sponsored by the Program and Papers Committee, A.F.A. Malleable Division, have been published in a single volume, the MALLEABLE FOUNDRY SAND AND CORE PRACTICE SYMPOSIA.

Included in the 1945 symposium on sand control are: *Sand Control in a Malleable Foundry*, D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.; *A Sand Control Program in a Mechanized Malleable Foundry*, by the same author; *Malleable Sand Control*, a summary of a questionnaire to 14 foundries; *Sand Control in a Malleable Foundry*, Gordon Davis, International Harvester Co., Chicago, and *Malleable Sand Control in a Large Mechanized Foundry*, J. J. Clark, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.

On foundry core practice, papers in the 1946 symposium are: *Malleable Foundry Coremaking Practice*, D. F. Sawtelle; *Malleable Iron Foundry Core Practice*, Eric Weller, Union Malleable Iron Works, East Moline, Ill.; *Malleable Foundry Core Sand Practice*, J. J. Clark; *Cores for Automotive Malleable Castings*, W. G. Ferrell, Auto Specialties Manufacturing Co., St. Joseph, Mich., and *Malleable Coremaking Practice*, E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.

Copies are available at \$2.00 to A.F.A. members, \$3.00 to non-members, from the American Foundrymen's Association, 222 W. Adams St., Chicago 6.

AMERICAN FOUNDRYMAN

# ★ NEW A. F. A. MEMBERS ★

(Covering the period from November 15 to December 15)

● Thirty-one chapters of the 33 contributed to this month's new member total of 189. The Eastern Canada and Newfoundland chapter kept its place among the pacesetting chapters by contributing 17 new members. However, two chapters, Chicago and St. Louis District, placed 20 and 18 new names, respectively, in their chapter membership record books.

## BIRMINGHAM DISTRICT CHAPTER

William L. Allen, Gen. Mgr., Dimick Casting Co., Birmingham.  
E. W. Copeland, Alabama Clay Products Co., Birmingham.  
Frank E. Nabers, Jr., Vice-Pres. Sales, Southern Ferro Alloys Co., Chattanooga, Tenn.

## CANTON DISTRICT CHAPTER

R. Dale George, Supt. Fdry., Minerva Foundry, Inc., Minerva, Ohio.

## CENTRAL ILLINOIS CHAPTER

D. E. Randall, Serv. Engr., Independent Pneumatic Tool Co., Chicago.

## CENTRAL INDIANA CHAPTER

J. H. Brannan, Sales, National Carbon Co., Inc., Chicago.  
Albert Seymour, Fore., Hoosier Iron Works, Kokomo, Ind.  
Temple W. Wilson, Asst. Fore., Langsenkamp & Wheeler Brass Works, Inc., Indianapolis.

## CENTRAL NEW YORK CHAPTER

Alton Bardeen, Ingersoll-Rand Co., Painted Post.  
Jules LeMaitre, Supt., Frazer & Jones Co., Syracuse.  
Everett H. Pitts, Ingersoll-Rand Co., Painted Post.

## CENTRAL OHIO CHAPTER

\*Furnace Foundry Co., Jackson, Ohio (D. A. Evans, Mgr.)

## CHICAGO CHAPTER

Stanley N. Anderson, Gen. Fore. Core Room, Howard Foundry Co., Chicago.  
Robert P. Barr, Fore., Howard Foundry Co., Chicago.  
Donald S. Cameron, Refractory Engr., The Mullite Refractories Co., Shelton, Conn.  
Lee Cress, Patt. Shop Supt., Howard Foundry Co., Chicago.  
Henry Freeman, Owner, Squire Coaswell Co., Chicago.  
A. C. Halliday, Sales, National Carbon Co., Inc., Chicago.  
Harold F. Hanssen, Pattn. Dept. Mgr., Howard Foundry Co., Chicago.  
Melvin Isaacson, Fore., Silverstein & Pinsof, Inc., Chicago.  
Henry E. Koepke, Pttin. Engr., Howard Foundry Co., Chicago.  
John J. McLane, Fore., Howard Foundry Co., Chicago.  
William J. Meid, Pyro Clay Products Co., Oak Hill, Ohio.  
William E. Monzel, Fdry. Fore., Howard Foundry Co., Chicago.  
John J. Pauly, Expediter, Nichol Straight Foundry Co., Chicago.  
Keshav M. Pillai, Met. Trainee, Whiting Corp., Harvey, Ill.  
Frank W. Porter, Engr., Lester B. Knight & Associates, Inc., Chicago.  
Eugene W. Smith, Western Materials Co., Chicago.  
Bernard I. Stern, Fore., Silverstein & Pinsof, Inc., Chicago.  
John S. Townsend, 332 S. Michigan Ave., Chicago.  
Al Tragarz, Fore., International Harvester Co., McCormick Works, Chicago.  
Stephens Zelencik, Partner, Hammond Pattern Works, Hammond, Ind.

## CINCINNATI DISTRICT CHAPTER

F. W. Gras, Salesman Buyer, Israel Bros. Co., Dayton, Ohio.  
A. L. Munson, Sales, National Carbon Co., Inc., Chicago.  
Thomas J. Reilly, Asst. Foreman, Lunkenheimer Co., Cincinnati.

## DETROIT CHAPTER

E. T. Anderson, Sales, National Carbon Co., Inc., Chicago.  
\*H & H Foundry Supply Co., Detroit, Mich. (Ralph V. Campbell, Foundry Engr.)  
Robert C. Harrell, Fdry. Engr., Kaiser-Frazer Corp., Willow Run, Mich.

\*Company Members.

Jack C. Keller, Engr., Giffels & Vallet, Inc., Detroit.  
William J. Mott, Ltb. Tech., Cadillac Motors Div., General Motors Corp., Detroit.  
Elton Rogers, Vice-Pres., E. J. Woodison Co., Detroit.  
Ronald M. Warrick, Cupola Fore., Cadillac Motors Div., General Motors Corp., Detroit.  
Robert J. Westenberg, Co-op Eng. Student, Cadillac Motors Div., General Motors Corp., Detroit.  
\*E. J. Woodison Co., Detroit (John E. Woodison, Pres.)

## E. CANADA & NEWFOUNDLAND CHAPTER

Rene Belisle, Works Mgr., J. A. Gosselin Co. Ltd., Drummondville, Que.  
Philip S. Brown, Mgr., B. G. Mfg. Ltd., Verdun, Que.  
Frank Clark, Met., Dominion Engineering Works, Ltd., Montreal, Que.  
Raymond H. Cormier, Pattern Stores, Robert Mitchell Co. Ltd., Montreal, Que.  
George Couture, Inst., Montreal Technical School, Montreal, Que.  
Lucien Dancause, Supt., Forano Ltd., Plessisville, Que.  
J. A. Douglas, Night Fdry. Fore., Warden King, Ltd., Montreal, Que.  
Harve Girard, Foundry Fore., Industrial Pattern & Foundry Works, Montreal, Que.  
Robert Hugh Guyan, Pattmkr., Robert Mitchell Co. Ltd., Montreal, Que.  
Richard Harper, Asst. Supt., Peacock Bros. Ltd., Ville LaSalle, Que.  
Wilfred Lemay, Moulder, Dominion Engineering Works, Ltd., Lachine, Que.  
Jos. Proulx, Fore., J. A. Gosselin Co. Ltd., Drummondville, Que.  
P. E. Savignac, Owner, Marquette Foundry, Montreal, Que.  
D. Sebastianowitch, Melter, Dominion Engineering Works, Ltd., Lachine, Que.  
Borden Semeniv, Lab. Asst., Crane Ltd., Montreal, Que.  
Chas. K. Webb, Supt., B. G. Mfg. Ltd., Montreal, Que.  
Joe Wozny, Fdry. Production Chaser, Jenkins Bros. Ltd., Montreal, Que.

## METROPOLITAN CHAPTER

Karl R. Douglas, Master Mechanic, Somerville Iron Works, Somerville, N. J.  
Duncan M. Wilson, Asst. Met., American Brake Shoe Co., Mahwah, N. J.

## MEXICO CITY CHAPTER

Carlos Taffinder, Chief of Fdry. Dept., Fabricacion de Maquinas, S. A., Monterrey, N. L.

## MICHIANA CHAPTER

D. R. Craft, Purchasing, Allis-Chalmers Mfg. Co., La Porte, Ind.  
Roy A. Halversen, Dir. of Analytical Res., Aeromotive Engineering Co., Niles, Mich.  
Elmer F. Mattern, Sec.-Treas., Standard Foundry Co., Inc., Wabash, Ind.  
John O. Parker, Chief Chemist, Aeromotive Engineering Co., Niles, Mich.  
\*Standard Foundry Co., Inc., Wabash, Ind. (James G. Cowen, Pres.)

## NORTHEASTERN OHIO CHAPTER

Carl Kocina, Wellman Bronze & Aluminum Co., Cleveland.  
Donald Smith, Wellman Bronze & Aluminum Co., Cleveland.  
Robert A. Thomas, Wellman Bronze & Aluminum Co., Cleveland.  
Lewis Youmell, Fore., National Malleable & Steel Castings Co., Cleveland.

## NORTHERN CALIFORNIA CHAPTER

Morris F. Furtado, Asst. Fore., Vulcan Foundry Co., Oakland.  
Leland L. Truitt, Sales Engr., E. J. Bartells Co. of Calif., San Francisco.

## NO. ILLINOIS & SO. WISCONSIN CHAPTER

John H. Arand, Foreman, Greenlee Bros. & Co., Rockford, Ill.  
Carl L. Dahlquist, Fdry. Tech., Greenlee Bros. & Co., Rockford, Ill.  
Richard E. Haughton, Foreman, Greenlee Bros. & Co., Rockford, Ill.  
Peter C. Paulkitis, Buyer, Twin Disc Clutch Co., Rockford, Ill.  
Victor R. Preston, Mgr., Olson Pattern & Die Shop, Inc., Rockford, Ill.  
Clayton Rice, Maint. Supv., Gunitite Foundries Corp., Rockford, Ill.

## NORTHWESTERN PENNSYLVANIA CHAPTER

William S. Duncan, Salesman, Pickands, Mather & Co., Erie, Pa.

## ONTARIO CHAPTER

W. B. Anstey, Salesman, Frankel Bros. Ltd., Toronto.  
C. M. Helyar, Pres., Furnasmon Mfg. Co. Ltd., Winnipeg, Man.

## OREGON CHAPTER

Fred Austin, Engr., Columbia Steel Casting Co., Portland.  
Dale Calkins, Ptn. Clerk, Electric Steel Foundry Co., Portland.  
Andrew J. Grbavac, Supt., Columbia Steel Casting Co., Portland.  
O. W. Kramer, Met., Columbia Steel Casting Co., Portland.  
G. K. Remington, Mgr., Columbia Steel Casting Co., Portland.

## PHILADELPHIA CHAPTER

Louis A. Bowman, Pres., Lumberton Sand Co., Philadelphia.  
Alfred Boyles, Met., U. S. Pipe & Foundry Co., Burlington, N. J.  
Thomas E. Gregory, Met., Baldwin Locomotive Works, Eddystone, Pa.  
Emanuel Kruse, Owner, Kruse Pattern Works, Camden, N. J.  
\*S. Morgan Smith Co., York, Pa. (C. W. Schaberg, Foundry Insp.)  
Joseph Thorn, Fore., Fletcher Works, Inc., Philadelphia.  
Chas. Wickersham, Asst. Fore., Atlantic Steel Casting Co., Chester, Pa.

## QUAD-CITY CHAPTER

\*The Bettendorf Co., Bettendorf, Iowa (W. E. Bettendorf, Pres.)  
Medie Hakeman, Union Malleable Iron Works, E. Moline, Ill.  
M. H. Kramer, Salesman, Republic Coal & Coke Co., Chicago.  
Ellwyn Kroeger, Owner, Le Claire Mfg. Co., Le Claire, Iowa.  
A. A. Zuber, Supt., Carver Pump Co., Muscatine, Iowa.

## ROCHESTER CHAPTER

Frank Breslin, Melter, The Anstice Co., Inc., Rochester, N. Y.  
Joseph Camillaci, Sls. Fore., Symington Gould Corp., Rochester, N. Y.  
James A. Matrachison, Fore. Mold. Dept., Symington Gould Corp., Rochester, N. Y.  
William L. Straube, Fore., General Railway Signal Co., Rochester, N. Y.

## SAGINAW VALLEY CHAPTER

Mark J. Bailey, Sub. Fore., Dow Chemical Co., Bay City, Mich.  
Howard E. Bowen, General Foundry & Mfg. Co., Flint, Mich.  
Hazen L. Kenny, Fore., Chevrolet Grey Iron Foundry, General Motors Corp., Saginaw, Mich.  
Marvin H. Males, Core Room Supt., Dow Chemical Co., Bay City, Mich.  
J. Martinski, Fore., Dow Chemical Co., Bay City, Mich.

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Nicholas Bartlett, Prod. Mgr., H. W. Clark Co., Mattoon, Ill.  
Pete J. Dapkus, Fdry. Engr., 640 Atlanta, Webster Groves, Mo.  
Harry A. Eibe, Supt. Ptn. Shops, General Steel Castings Corp., Granite City, Ill.  
H. T. Gibbons, Shop Supt., U. S. Radiator Corp., Edwardsville, Ill.  
Fred E. Fogg, Sales Engr., Acme Foundry & Machine Co., Coffeyville, Kansas.  
Eugene W. Fry, Asst. Fdry. Supt., Acme Foundry & Machine Co., Coffeyville, Kansas.  
Robert F. Gibbons, Process Insp., General Steel Castings Corp., Granite City, Ill.  
M. N. Gruner, Repr., Harbison-Walker Refractories Co., St. Louis.  
Ray Hickerson, Fore., Proc. Insp., General Steel Castings Corp., Granite City, Ill.  
Frank Leonard, Gen. Mgr., Acme Brass Foundry, St. Louis.  
John Manterer, Supt., Enterprise Foundry, Belleville, Ill.  
Tom C. Muff, Engr., Sorbo-Mat Process Engineers, St. Louis.  
G. F. Naumann, Mgr., U. S. Radiator Corp., Edwardsville, Ill.  
F. G. Nichols, Gen. Fore., Southern Wheel Div., American Brake Shoe Co., St. Louis.  
Fred O. Reed, Gen. Fore., American Steel Foundries, St. Louis.  
Milton Rosenberg, Prod. Engr., Enterprise Foundry, Belleville, Ill.  
Wm. J. H. Schrumm, Jr., Process Insp., General Steel Castings Corp., Granite City, Ill.  
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Homer H. Harlow, Jr., Molder, Rich Mfg. Co., Los Angeles.  
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Edgar McCashen, Supt., Berg Metals Corp., Los Angeles.  
John P. Siegler, Sls. Engr., Rogers Pattern & Foundry Co., Los Angeles.  
Charles Tingler, Fore., Rogers Pattern & Foundry Co., Los Angeles.

\*Company Members.

## TEXAS CHAPTER

W. B. Steuer, Owner, W. B. Steuer, Houston.

## TOLEDO CHAPTER

John G. Blake, Supt., Alloy Founders, Inc., Toledo, Ohio.  
Adolph Jacobson, Zoller Casting Co., Bettsville, Ohio.  
Wm. Rudow, Owner, 1907 Monroe, Toledo, Ohio.  
Hugh Scott, Supt., Alloy Founders, Inc., Toledo, Ohio.  
David Steinpres, Zoller Casting Co., Bettsville, Ohio.

## TWIN CITY CHAPTER

Howard J. Enochson, Core Room Fore., South Park Foundry & Mfg. Co., St. Paul, Minn.  
George W. Kelley, Core Rm. Fore., Minneapolis Electric Steel Castings Co., Minneapolis.  
Vernon Swan, Fdry. Supt., National Pressure Cooker Co., Eau Claire, Wis.

## WESTERN MICHIGAN CHAPTER

Paul D. C. Baldwin, Asst. Supt., Lakey Foundry & Machine Co., Muskegon.  
Hale Burnham, Supt., Lakey Foundry & Machine Co., Muskegon.  
John F. Carpenter, Supt., Lakey Foundry & Machine Co., Muskegon.  
Arthur F. Jeannot, Jr., Cleaning Rm. Supt., West Michigan Steel Foundry Co., Muskegon.  
Vincent Jeannot, Chief Insp., West Michigan Steel Foundry Co., Muskegon.  
Earl C. Jensen, Ptn. Storage Fore., West Michigan Steel Foundry Co., Muskegon.  
Frank C. Kent, Cost Dept., West Michigan Steel Foundry Co., Muskegon.  
Rowland L. Leistiko, Chief Insp., Lakey Foundry & Machine Co., Muskegon.  
George S. Linberg, Cost Acct., Campbell, Wyant & Cannon Foundry Co., Muskegon Heights.  
Austin F. Nelson, Engr., Lakey Foundry & Machine Co., Muskegon.  
John D. Peterson, Ptn. Shop Fore., West Michigan Steel Foundry Co., Muskegon.  
Herbert M. Shuman, Chief Dftsman, Campbell, Wyant & Cannon Foundry Co., Muskegon.

## WESTERN NEW YORK CHAPTER

Emmett Brown, Metal & Alloy Specialties Co., Buffalo.  
Harvey Lilga, Metal & Alloy Specialties Co., Buffalo.  
Anthony P. Marcolini, Appr., Dobbie Foundry & Machine Co., Niagara Falls.  
Edward Miller, Metal & Alloy Specialties Co., Buffalo.  
Anthony Nowicki, Metal & Alloy Specialties Co., Buffalo.  
Ray L. Sours, Metal & Alloy Specialties Co., Buffalo.  
Reginald Wheeler, Metal & Alloy Specialties Co., Buffalo.

## WISCONSIN CHAPTER

S. N. Denkinger, Atlas Pattern Works, Milwaukee.  
Bernard Fridl, Wks. Mgr., The Vilter Mfg. Co., Milwaukee.  
M. B. Inman, Sales, National Carbon Co., Inc., Chicago.  
LeRoy W. Paulin, Fdry. Student, International Harvester Co., Milwaukee.  
George Reinhardt, Fore., Central Pattern Works, Inc., Racine.  
Sven Sandelin, Jr., Mgr., Central Pattern Works, Inc., Racine.  
Bernard Uphoff, Fore., Allis-Chalmers Mfg. Co., West Allis Works, Milwaukee.

## OUTSIDE OF CHAPTER

\*Darling Valve & Mfg. Co., Williamsport, Pa. (Carl H. Simon, Chief Engr.)  
Paul F. Hughes, Tech. Inst., Massachusetts Institute of Technology, Cambridge.  
E. F. Tibbetts, Engr., Bethlehem Steel Co., Shipbldg. Div., Quincy, Mass.  
Tsun Hsiang Chen, Westinghouse Electric Corp., Trafford Works, Trafford, Pa.  
Harold W. Wyatt, Instr., Massachusetts Institute of Technology, Cambridge.

### Brazil

Dalcy H. Machado, Engr., Elevadores Atlas Sa., Sao Paulo.

### England

Edward Ayres, 42 Primrose View, Sheffield 8.  
Fulmer Research Institute Ltd., Stoke Poges, Bucks.  
Wm. Jessop & Sons, Inc., Sheffield.

### Holland

A. J. Ingen Housz, Dir., Diepenbroel & Reigers N. V., Ulft.

### Norway

Ulefos Jernvaerk, Ulefoss.

### Sweden

Surahammars Bruks Aktibolag, Surahammar.

AMERICAN FOUNDRYMAN

# WASHINGTON CHAPTER Is Installed by 'Remote Control'

THE FAMOUS CAST IRON RATTLE arrived (symbolically) in gay wrappings as an eagerly-awaited gift from A.F.A. to Washington foundrymen, who enthusiastically celebrated the official installation of their new-born chapter, the 34th of the Association, during a gala Christmas Party on December 20 at the United Nations Banquet Hall, Seattle.

A.F.A. National Director S. D. Russell, Phoenix Iron Works, Oakland, Calif., made history, as he 'presented' the rattle, traditionally emblematic of the 'baby' A.F.A. chapter, from an altitude of some 6,000 feet where his plane circled and was turned back because of "ceiling zero" fog, to Chapter Chairman C. M. Anderson, Eagle Brass Works, Seattle. Mr. Russell reports that, at exactly the proper moment, the rattle shook of its own volition.

Meanwhile, the giant stork wheeled overhead (the great bird, having de-

ful establishment of a chapter in a region where interest long had been evident.

When Chairman Anderson brought down the gavel with the announcement that the Washington chapter had been formed, the group was launched on its program of bringing the full weight of Association assistance to the foundry industry of the area.

A.F.A. National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, wired: "Please accept my sincere personal congratulations on this founding day of the Washington chapter, A.F.A. You are entering into an exciting experience for the betterment of the foundry industry. I predict that you will find it not only exciting, but profitable as well. I regret my inability to be with you in person . . . My congratulations to you all."

As announced in the December issue of *AMERICAN FOUNDRYMAN*, the A.F.A. National Board of Directors had unanimously approved a chapter petition bearing signatures of 72 Pacific Northwest foundrymen, representing some 36 operating companies, and officers and directors had been elected at an earlier meeting to serve for the coming year.

Heading the program committee for the Christmas Party as Chairman was C. F. Miller, Carl F. Miller & Co., Seattle. Other committee members were: Chapter Chairman Anderson; Chapter Vice-Chairman G. E. Rauhen, Olympic Foundry Co., and Chapter Secretary-Treasurer A. D. Cummings, Western Foundry Sand Co., all of Seattle.

## Plan 35th Chapter For Denver Area

PETITION for formation of the 35th A.F.A. chapter, the Rocky Mountain chapter with headquarters at Denver, Colo., has been forwarded to the Association for consideration of its Board of Directors, following an enthusiastic "expectancy meeting" at the Navarre Hotel, Denver, on December 3.

The 42 foundrymen who gathered for the dinner and business meeting elected an acting chairman, J. L. Higson, Western Foundry, Denver, who presided, and an acting secretary, P. M. Payne, Rotary Steel Castings Co., of the same city; voted unanimously to petition for an A.F.A. chapter and turned in signatures of 71 individuals, representing 35 companies; and scheduled another meeting for January 14 at the Oxford Hotel, Denver, after setting up a nominations committee and a by-laws committee.

It is hoped by the area founders, who went home from the meeting elated at the prospects of a local group within the near future, that the January meeting may see the formal installation of the chapter.

Present plans call for the new group to take in Colorado and Utah, and probably southeastern Wyoming, southwestern Nebraska and western Kansas.

E. B. Zabriskie, Magnus Metal Div., National Lead Co., was named *Chairman* of the nominating committee. Members of his group are: B. E. Dixon, American Manganese Steel Div., American Brake Shoe Co.; A. L. Schneider, Western Bronze & Brass Foundry; W. H. Bachman, Card Iron Works Co., and C. R. Kasch, Electron Corp. All are of Denver.

On the by-law committee, W. R. Manske, American Manganese Steel Div., serves as *Chairman*, and J. W. Horner, Slack-Horner Brass Manufacturing Co.; P. M. Payne; E. B. McPherson, McPherson's Aluminum & Brass Foundry, and C. E. Stull, Manufacturers Foundry Corp., are members. All are of Denver.

## Philadelphia Regional Conference Correction

*AMERICAN FOUNDRYMAN* regrets erroneous company affiliation (American Locomotive Co.) listed for William B. Given, Jr., President, American Brake Shoe Co., New York, in the Philadelphia regional conference write-up which appeared in our December issue. Mr. Given was principal speaker at the management meeting preceding the conference; and on this occasion Ralph Kelly, President, Baldwin Locomotive Works, Philadelphia, acted as toastmaster.



livered the latest husky Association youngster, was later reported winging on a Denver, Colorado-Tulsa, Oklahoma, course).

National Director Russell, enroute to the installation ceremonies found his train four hours behind schedule at Portland, switched to air transport; and, thus, was overhead for 'remote control' installation.

Members of Washington chapter and their friends enjoyed a full evening of pleasure, interrupted only by the welcome installation ceremony. Music and dancing, a floor show, and other entertainment provided a memorable program, and a suitable celebration for the success-

# ★ CHAPTER ACTIVITIES ★

## news

### Central Ohio

D. E. Krause  
Battelle Memorial Institute  
Chapter Reporter

SECTIONAL MEETINGS on steel and gray iron provided an interesting evening and valuable technical discussion for members of Central Ohio A.F.A. chapter at the November 25 meeting in the Hotel Chittenden, Columbus.

The steel group heard a panel consisting of W. T. Bland, Commer-

cial Steel Casting Co., Marion, Ohio; F. O. Lemmon, Ohio Steel Foundry Co., Springfield, Ohio, and Chapter Treasurer R. H. Frank, Bonney-Floyd Co., Columbus. Such casting defects as cracks, hot tears, porosity and surface checking, or cracking, on large flat areas of heavy castings, came up for thorough discussion. In the case of the last defect, which is not common and is often referred to as "chicken-wire" cracks due to appearance, one of the members reported that he had

eliminated the trouble by the unorthodox method of using hot cores directly from the oven at 500° F.

Some causes of defective castings in gray iron were reviewed and discussed at the second table. Discussion leader was D. E. Krause, Battelle Memorial Institute, Columbus.

### Northern California

C. R. Marshall  
Chamberlain Co.  
Chapter Co-Secretary

ONE FEATURE OF THE EVENING at the Northern California A.F.A. chapter meeting in the Engineers Club, San Francisco, on November 1, was a report on the activities of the chapter in sponsoring an exhibit demonstrating the Boy Scout Merit Badge for Foundry Practice at the "Scout-O-Rama," to be held in Oakland Auditorium, Oakland, on February 20-22. Hearty response to the project, which will be, at once, a tangible contribution to the scouting movement, and an opportunity to introduce the opportunities of the foundry industry to the boys, was forthcoming from chapter members.

Offers of supplies and equipment for the exhibit and other types of assistance were quickly made from the floor to the educational commit-

*At Detroit A.F.A. chapter's reunion of past officers and directors, December 5 at the Fort Shelby Hotel: left to right, top, W. J. Muhltner, Great Lakes Foundry Sand Co., Detroit; P. W. Mulder, Almont Manufacturing Co., Imlay City, Mich.; G. C. Creusere, Semet-Solvay Co., and H. H. Wilder, Eaton Manufacturing Co., both of Detroit. Bottom (left)—Chapter Director E. C. Hoenicke, Eaton Manufacturing Co.; Chapter Chairman A. H. Allen, Penton Publishing Co.; A. T. Waterfall, past A.F.A. National President, now retired; Chapter Director R. G. McElwee, Vanadium Corp. of America; bottom (right)—H. H. Wilder, and O. E. Goudy, Cadillac Motor Car Div., General Motors Corp., all of Detroit.*



tee, which is directing the chapter cooperation.

Chapter President Richard Vosbrink, Berkeley Pattern Works, Berkeley, also called upon membership chairman H. M. Donaldson, Brumley-Donaldson Co., San Francisco, who introduced the new members present at the meeting; on W. W. Clark, Enterprise Engine & Foundry Co., San Francisco, chairman of the chapter melting control committee, and on F. A. Mainzer, Pacific Brass Foundry, of the same city, chairman of the finance committee, for reports of their groups.

The meeting was then turned over to program chairman George McDonald, H. C. Macaulay Foundry Co., Oakland, who introduced the speaker of the evening, L. C. Young, S P O, Inc., Cleveland.

Mr. Young, discussing "Machine Molding in the Foundry," pointed

out the various applications of machine molding that are now common in the East and explained some of the advances made in molding machine design.

### Mexico City

N. S. Covacevich  
Casa Covacevich  
Chapter Secretary

ONE YEAR of gradual development, expected to lead to a future of expanded activities for Mexico City A.F.A. chapter, was celebrated with a special program on Novem-

ber 7, first anniversary of the group.

The official program opened with registration of all members at the chapter headquarters, Barcelona No. 11, Mexico City, and the presentation to the members of special identification badges. Reservations and travel facilities were provided for out-of-town visitors, as well as chapter members, and the foundrymen set out on a visit to La Consolidada, S. A.

Several groups were formed and conducted by competent guides through the plant, which manufactures a wide variety of articles and has one of the largest steel foundries

*Mexico City A.F.A. chapter celebrated its first anniversary with a special program for foundrymen of the area. Two highlights were the luncheon (top) given the foundrymen at the conclusion of their tour through the facilities of the La Consolidada, S.A., and the official banquet (bottom) at the Restaurant Chapultepec, which concluded the day's activities.*



in the country. Following the tours, the foundrymen were guests of the company at a luncheon served in its dining room.

Returning to the chapter headquarters, the group participated in the business and technical sessions of the meeting. At this time, Ing. Ernesto Villaboros, Construcción y Maquinaria S. de R. L., Chapter President, extended the official welcome of the chapter to its guests.

The program was concluded with a banquet at the Restaurant Chapultepec, where good food and music were enjoyed by all.

### Birmingham District

J. P. McClendon  
Stockham Pipe Fittings Co.  
Chairman, Publicity Committee

DISTINGUISHED GUEST SPEAKERS were greeted by one of the largest attendances in Birmingham District A.F.A. chapter history at the November 8 meeting in the Tutwiler Hotel, Birmingham. More than 125 members and their friends were present for the dinner and technical session, to hear H. H. Berresford, managing director, Stavelay Coal & Iron Co., Chesterfield, England, and Dr. J. E. Hurst, director of research for the same firm and internationally recognized for his achievements in the field of metallurgy.

Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, introduced Mr. Berresford at the dinner; and the visitor discussed current aspects of the industrial picture in Britain.

Dr. Hurst was presented at the technical session by W. O. McMahon, foundry consultant, Birmingham. The speaker described the conditions faced in British plants under war-time blackout regulations, and expressed appreciation for the aid rendered by American industries.

Dr. Hurst, who is a past president of the Institute of British Foundrymen, suggested to the local foundrymen an exchange of technical papers between Birmingham District A.F.A. chapter and the Birmingham, England, branch of the I.B.F. Chapter Chairman T. H. Benners, Jr., T. H. Benners & Co., Birmingham, was asked by the membership to work out details of the exchange.

Another subject of great interest during the general portion of the

evening was the forthcoming 15th Annual Foundry Practice Conference, which will be held February 20-22. The conference program is listed on Page 72 of this issue.

### Southern California

Maurice Beam  
Chapter Reporter

THE NEED for apprentice trainees in the foundry was driven home in the minds of foundrymen at the November 8 meeting of Southern California A.F.A. chapter in Rodger Young Auditorium, Los Angeles, by a rousing discussion in response to a remark that the "floor molder, truly an artist in his line, is dying out,"

by speaker of the evening L. C. Young, SPO, Inc., Cleveland.

It was the consideration of "What are we going to do when they are all dead?" that brought up a summarization on apprentice training in the general discussion period following Mr. Young's talk on "Machine Molding." The speaker presented a comparison between production by machine and by hand, and detailed many interesting facts regarding machine performance, applications, and design. He stressed that patterns must be built for machine use, that the "know-how" of this technique is most important, and that "good housekeeping" plays an important role.

On December 7 the chapter

*Scenes from another exceptional technical session at Birmingham District A.F.A. chapter, November 8, at the Tutwiler Hotel, Birmingham: top, left to right, Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, and a Director of the chapter; H. H. Berresford, managing director, and Dr. J. E. Hurst, director of research, Stavelay Coal & Iron Co., Chesterfield, England, speakers of the evening; Chapter Chairman T. H. Benners, Jr., T. H. Benners & Co.; Chapter Secretary-Treasurer F. K. Brown, Adams, Rowe & Norman, Inc., and Chapter Vice-Chairman W. E. Jones, Stockham Pipe Fittings Co., all of Birmingham.*





*Southern California A.F.A. chapter members "lined up" for a lively discussion on machine molding, at the November 8 meeting in Rodger Young Auditorium, Los Angeles. Shown here are, left to right: Chapter Treasurer E. D. Shomaker, Kay-Brunner Steel Products, Inc., Alhambra, Calif.; Chapter President W. D. Emmett, Los Angeles Steel Castings Co., Los Angeles; L. C. Young, SPO, Inc., Cleveland, speaker of the evening; Chapter Vice-President H. E. Russill, Eld Metal Co., Ltd., Los Angeles; Chapter Secretary L. O. Hofstetter, Brumley-Donaldson Co., of the same city (all standing), and (seated) B. G. Emmett, Los Angeles Steel Castings Co., a past Chapter President; Professor Cady, University of Southern California, and Gordon Sondraker, Chamberlain Co., all of Los Angeles.*

played host to 300 foundrymen at Rodger Young Auditorium on the occasion of its "Christmas Stag Party." The 'get-together' provided good food, plenty of entertainment and a full evening of merriment to the members and their friends, and was adjudged an outstanding success.

### Central Indiana

J. W. Giddens  
International Harvester Co.  
Chapter Reporter

CHOICE of molding sands for a given job is determined by the size, shape and desired finish of the casting. C. B. Schureman, F. E. Schundler & Co., Joliet, Ill., told members of Central Indiana A.F.A. chapter as he spoke on "Foundry Sands" before the technical session of the December 2 meeting in the Hotel Antlers, Indianapolis.

The speaker emphasized his statement that a good molding sand should be sub-angular in shape and should vary in grain size; and also

stressed the importance of proper mixing and mulling, outlining a sequence for the operations involved, which should give consistent results.

Mr. Schureman warned the foundrymen that devices used for measuring sand or additives must be constantly checked if sand control is to be effective. As an added suggestion, the speaker described a casting which, in his opinion, could be used in every foundry to check the sand in use.

Technical chairman for the evening was Paul Faulk, Electric Steel Castings Co., Indianapolis, who handled the meeting during the discussion period.

### Canton District

N. E. Moore  
Wadsworth Testing Laboratory  
Chapter Reporter

ROUND TABLE DISCUSSIONS on patternmaking, iron, steel, non-ferrous metals and time study made up the program for some 80 members and guests at the November 14 meeting of Canton District A.F.A. chap-

ter in the Elks Club, Alliance, Ohio.

Chapter Chairman I. M. Emery, Massillon Steel Castings Co., Massillon, Ohio, presided at a brief business session, during which the membership heard a report of the chapter educational committee regarding that group's work, in cooperation with the public schools, toward setting up a uniform apprentice training course for the foundry industry.

Chapter Secretary C. B. Williams, Massillon Steel Castings Co., led the discussion group on steel; T. M. Dubs, Canton Pattern & Manufacturing Co., Canton, Ohio, that on patterns; Lewis Way, Columbiana Foundry Co., Columbiana, Ohio, the iron group; Ernest Hess, retired and a past chairman of Northeastern Ohio A.F.A. chapter, the non-ferrous table, and E. L. Greenman, American Steel Foundries, Alliance, the time study session.

### Northeastern Ohio

W. G. Gude  
The Foundry  
Chairman, Publicity Committee

SIMULTANEOUS SESSIONS, on gray iron, malleable iron, non-ferrous metals and patternmaking, featured the technical program at the November 14 meeting of Northeastern Ohio A.F.A. chapter in the Cleveland Club, Cleveland.

J. G. Goldie, M. B. M. Foundry Co., and C. U. Geesey, Superior Foundry Co., both of Cleveland, presided for the gray iron group. Discussion concerned use of beehive coke and amorphous silica in the cupola, and also took in grain size

and permeability of cupola slagging.

Co-chairmen for the malleable session were Fred Ffarr, Lake City Malleable Co., and Elmer Zirzow, National Malleable & Steel Castings Co., both of Cleveland and current directors of the chapter. Casting defects was the topic, and the group was provided with a number of castings with typical defects. After these had been passed around to members, opinions were solicited as to the cause of the defects and steps necessary to eliminate such trouble. Use of the castings added to the interest of the foundrymen in the discussion, and assisted in classification of types of defects commonly encountered.

Patternmakers heard Louis Schmidt, Aluminum Co. of America, Cleveland, present "Elements to be Considered in Estimating Pattern Costs" at their session; and the non-ferrous table was featured by a lively discussion on methods for uniform production of aluminum castings to the exacting specifications of the purchaser. A. H. Hinton, Aluminum

Co. of America, and Frank Nemicik, Apex Electrical Manufacturing Co., Cleveland, acted as co-chairmen for the latter meeting.

#### Central New York

J. A. Feola  
Crouse-Hinds Co.  
Chairman, Publicity Committee

ORGANIC AND INORGANIC materials used as binders in cores and molds and the results obtained by their use alone and in combination, proved an absorbing topic at the technical session of the November 15 meeting of Central New York A.F.A. chapter in the Onondaga Hotel, Syracuse. J. A. Gitzen, Delta Oil Products Co., Milwaukee, was the speaker of the evening; he was introduced by Chapter Chairman E. E. Hook, Dayton Oil Co., Syracuse, who presided over the gathering of 110 members and guests.

Noting the increasing use of plastic type binders, particularly in magnesium foundries, the speakers stated that they had many possibilities and

would probably be more extensively applied in the future.

Developing his remarks in "Properties of Binders Used in the Foundry," Mr. Gitzen stressed the effect of excessive moisture on green strength, explaining that during baking the core temperature remains at 212 degrees F, so long as there is moisture in the core, and that, in many instances, the core is thoroughly baked only when molten metal is poured into the mold cavity. Such practice, he pointed out, results in dirty and porous castings, due to gas generated by the green core.

#### Chesapeake

J. A. Reese  
Koppers Co. Inc.  
Chapter Reporter

D. FRANK O'CONNOR, American Saw Mill Machinery Co., Hackettstown, N. J., and Chairman, A.F.A. Brass and Bronze Division, was speaker of the evening on "Practical Methods in the Production of Brass

(Continued on Page 74)

### FIFTEENTH ANNUAL FOUNDRY PRACTICE CONFERENCE

Birmingham District Chapter, A.F.A.

February 20-22

Tutwiler Hotel, Birmingham, Ala.

#### Thursday, February 20

9:00 am—Registration

10:30 am—Technical Session

CHAIRMAN, C. K. Donoho, American Cast Iron Pipe Co., Birmingham.

*Non-Ferrous Foundry Practice Symposium.*

12:30 pm—Luncheon

PRESIDING, W. E. Jones, Stockham Pipe Fittings Co., Birmingham.

SPEAKER, S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, A.F.A. National President.

2:30 pm—Technical Session

CHAIRMAN, J. A. Bowers, American Cast Iron Pipe Co.

*Precision Castings*, A. H. Homberger, Michigan Steel Casting Co., Detroit.

4:00 pm—Technical Session

CHAIRMAN, J. E. Getzen, H. G. Mouat Co., Birmingham.

*Foundry Sands*, T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

8:00 pm—Entertainment

PRESIDING, J. M. Bates, Moore-Handley Hardware Co., Birmingham.

#### Friday, February 21

9:00 am—Plant Visitations

2:00 pm—Technical Session

*Some Alloy Irons for Wear and Corrosion Resistance*, F. G. Sefing, International Nickel Co., New York.

3:30 pm—Technical Session

CHAIRMAN, Ned Brandler, Electro Metallurgical Co., Birmingham.

*Cupola Melting of Gray Iron*, W. B. McFerrin, Electro Metallurgical Co., Detroit.

7:00 pm—Annual Banquet

PRESIDING, T. H. Benners, Jr., T. H. Benners & Co., Birmingham.

*Current Trends*, Dr. J. L. Brakefield, Chamber of Commerce, Birmingham.

#### Saturday, February 22

9:00 am—Plant Visitations

## TENTH ANNUAL FOUNDRY CONFERENCE

Wisconsin Chapter, A.F.A.

February 13-14

Hotel Schroeder, Milwaukee, Wis.

### Thursday, February 13

- 9:00 am—Registration  
10:00 am—Opening Meeting  
*Address of Welcome*, M. O. Withey, University of Wisconsin, Madison.  
10:30 am—General Meeting  
*Good Housekeeping*, James Thomson, Continental Foundry & Machine Co., East Chicago, Ind.  
12:00 pm—Luncheon Meeting  
2:00 pm—Steel Session  
*Modern Developments in Gating and Riser*, H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.  
2:00 pm—Gray Iron Session  
*Core Sand Testing & Core Practice*, O. J. Meyer, Werner G. Smith Co., Cleveland.  
2:00 pm—Malleable Iron Session  
*Mechanization for the Malleable Jobbing Foundry*, L. B. Knight, Lester B. Knight & Associates, Chicago.  
2:00 pm—Non-Ferrous Session  
*Radiographic Examination of Brass and Bronze Castings*, W. H. Baer, Naval Research Laboratory, Washington, D. C.  
2:00 pm—Pattern Session  
*Plastic Patterns*.  
2:00 pm—Technical Session  
*Practical Interpretations of Hardenability*, E. J. Wellauer, Falk Corp., Milwaukee.  
3:40 pm—Steel Session  
*Reduce Costs by Eliminating Non-Essential Operations*, J. R. Adams, Crucible Steel Castings Co., Lansdowne, Pa.  
3:40 pm—Gray Iron Session  
*Cupola Control and Melting*, T. E. Barlow, Battelle Memorial Institute, Columbus, Ohio.  
3:40 pm—Malleable Session  
*Modern Inspection Methods of Malleable Castings*, U. S. Sullivan, Caterpillar Tractor Co., Peoria, Ill.  
3:40 pm—Non-Ferrous Session  
*Non-Ferrous Melting Atmospheres*, H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh, Pa.  
3:40 pm—Pattern Session  
*Magnesium Pattern Equipment*, Lee Cress, Howard Foundry Co., Chicago.  
3:40 pm—Technical Session  
*Dielectric Curing of Cores*, J. W. Cable, Induction Heating Corp., New York.

- 6:30 pm—Conference Banquet  
CHAIRMAN, Dr. Clark Kuebler, Ripon College, Ripon, Wis.

### Friday, February 14

- 10:00 am—Steel Session  
*Shot and Grit for Metal Blasting*, J. T. Gow, Battelle Memorial Institute.  
10:00 am—Gray Iron Session  
*Annealing and Stress Relief—Effect on Physical Properties*, J. S. Vanick, International Nickel Co., New York.  
10:00 am—Malleable Iron Session  
*Stack Molding in the Malleable Foundry*, L. D. Pridmore, International Molding Machine Co., Chicago.  
10:00 am—Non-Ferrous Session  
*Non-Ferrous Foundry Sands*, George Anselman, Goebig Mineral Supply Co., Chicago.  
10:00 am—Pattern Session  
*Copper Patterns by Electric Forming*.  
10:00 am—Technical Session  
*Recent Research in Machineability*, A. O. Smith, Kearney & Trecker Corp., Milwaukee.  
12:00 pm—Luncheon Meeting  
2:00 pm—Steel Session  
*What Do You Know About New Material and Methods for the Production of Steel Castings?*, C. W. Briggs, Steel Founders' Society of America, Cleveland.  
2:00 pm—Gray Iron Session  
*Synthetic Sand Control*, N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio.  
2:00 pm—Malleable Session  
*Some Factors Affecting Annealing*, W. D. McMillan, International Harvester Co., Chicago.  
2:00 pm—Non-Ferrous Session  
*Foundry Costs*, J. W. Wolf, Non-Ferrous Founders' Society, Chicago.  
2:00 pm—Pattern Session  
*New Pattern Methods*, A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.  
2:00 pm—Technical Session  
*Structure and Properties of Cast Iron*, C. O. Burgess, Union Carbide & Carbon Research Laboratory, Niagara Falls, N. Y.  
3:40 pm—General Meeting  
*Recent Progress of the Foundry Industry*, Frank Steinbach, The Foundry, Cleveland.

and Bronze Castings" for the November 22 meeting of Chesapeake A.F.A. chapter at the Engineers Club, Baltimore, Md.

The speaker stressed that, in the melting of red or yellow brass, furnace, crucible and ladle must be dry and free of dross and slag, and that a log of melting operations should be kept for later analysis. Melting should be done as quickly as possible to prevent gas absorption, and metal not be allowed to soak after melting, as that practice causes porosity.

In preparation of cores, Mr. O'Connor advised, the best practice is to begin with dry sand for accurate moisture control, and to use the binder with the least gas-producing composition. Hard ramming and the excessive use of reinforcing bars will cause blowing, and should be avoided. Mr. O'Connor concluded with the recommendation to supervision to follow through each operation, coordinating data for the production of quality castings.

### Saginaw Valley

J. J. Clark  
General Motors Corp.  
Chapter Director

ROUND TABLE DISCUSSIONS on steel, light metals and casting inspection, made up the technical program of the evening at the December 5 meeting of Saginaw Valley A.F.A. chapter in Fischer's Hotel, Frankenmuth, Mich., with 171 foundrymen on hand.

Gosta Vennerholm, Ford Motor Co., Dearborn, Mich., addressed those at the steel table on "Measurement of Temperatures of Molten Steel." His remarks, dealing mostly with details of radiation and thermocouple types of thermometers, equipped with recording instruments, evoked a lively and interesting discussion.

Herman Case, Buick Motor Div., General Motors Corp., Flint, Mich., led the discussion at the casting inspection session, drawing from his experiences in more than 30 years of such work. A large group of foundrymen attended and took part in the review of the topic.

At the third table, W. L. Bean, Continental Aviation and Engineering Corp., Detroit, spoke on "Simplification of Light Metal Casting



*The speakers' table at the November 7 meeting of Saginaw Valley A.F.A. chapter, at Frankenmuth, Mich.: left to right, Chapter Chairman J. F. Smith, Chevrolet Grey Iron Foundry Div., General Motors Corp., Saginaw, Mich.; E. E. Woodliff, Foundry Sand Engineering Co., Detroit, and speaker of the evening; Myron Booth, Saginaw Malleable Iron Div., General Motors Corp., Saginaw; William Mixer, Buick Motor Div., General Motors Corp., Flint, Mich., and J. E. Bowen, Chevrolet Grey Iron Foundry Div.*

Design and Its Effect on Serviceability." Emphasis was placed on selection of the proper metal for the application, and upon reduction of stress concentrations through design. Samples were displayed to illustrate features of design bearing upon serviceability of the part, and the foundrymen found the subject keenly interesting and worthy of discussion at length.

At the dinner preceding the business and technical portions of the evening, C. W. Bonbright, General Foundry & Manufacturing Co., Flint, delivered the coffee talk.

### Western New York

L. A. Merryman  
Tonawanda Iron Corp.  
Chapter Secretary

CORE MAKING was the subject of a study in contrasts at the December 6 meeting of Western New York A.F.A. chapter in the Hotel Touraine, Buffalo, as S. D. Martin, Central Foundry Div., General Motors Corp., Saginaw, Mich., discussed and demonstrated "Better Methods and Motion Study," assisted by A. M. Clark, of the same firm.

Chapter Chairman H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, presided over the business session, with 120 members and guests in attendance, then turned the meeting over to the technical chairman of the evening, L. C. Thellemann, Kencroft Malleable Co. Inc., Buffalo.

In his opening remarks, Mr. Martin emphasized the value of the study of motions in the elimination of unnecessary movements, and, thereby, improvement in methods of production. Applying the procedure to the foundry, Mr. Martin presented a study of coremaking; Mr. Clark carried out the operations under the original method, while the speaker presented a motion study breakdown, including measurement of the number of movements and the time required for each. Changes were then made in the layout of the core bench, location of sand bin and core wires, and height of bench; and a peening operation was eliminated in favor of jolting.

As a result of these, and other changes, Mr. Clark, in his following demonstration, showed an increase in production of 62.5 per cent.

All phases of the demonstrations, and of the subject were reviewed during the general discussion period.

### Rochester

D. E. Webster  
American Laundry Machinery Co.  
Chapter Director

WITH AN ATTENDANCE of some 80 members and guests, Rochester A.F.A. chapter devoted the meeting of November 12 in the Hotel Seneca, Rochester, to "Modernization in the Foundry," discussed by L. B. Knight, Lester B. Knight & Associates, Chicago.

Mr. Knight made it clear at the

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outset that the problem of modernization is not strictly one of mechanization alone, but, rather, of careful planning in regard to materials storage and handling, equipment location, sand preparation and the orderly flow of work through the foundry. All the foregoing operations have a bearing on time and labor expended in production, and, therefore, costs, Mr. Knight explained. He pointed out that, in some cases, installation of elaborate equipment resulted in an increase, rather than a reduction of costs.

## Ontario

R. C. Tiplady  
Westman Publications, Ltd.  
Director of Publicity

FOR AN ANNUAL OCCASION, its western Ontario meeting, Ontario A.F.A. chapter brought Dr. R. L. Lee, General Motors Corp, Detroit, to the Prince Edward Hotel, Windsor, on December 6 to speak on "Leadership," and more than 100 foundrymen availed themselves of the opportunity to attend, following the earlier portion of the program, visitations to the facilities of Walker Metal Products, Auto Specialties Manufacturing Co., Bryant Patterns and Ford Motor Co. of Canada.

Dr. Lee was introduced by H. N. Gregory, Walker Metal Products; and Chapter Chairman J. A. Wother-

spoon, Imperial Iron Corp., Ltd., St. Catharines, Ont., presided.

The speaker outlined fundamental characteristics of a leader, and went into detail regarding the relationship between a leader and the men under his direction. "A leader," he said, "is a man who is not afraid of his job, and who believes that his work is important . . . Leaders are men who work not only to get the means to live, but because they find in their work a reason for living."

At the conclusion of Dr. Lee's talk, W. H. Cantelon, Auto Specialties Manufacturing Co., expressed the appreciation of the Ontario foundrymen in moving a vote of thanks to the speaker. The meeting, which gave Windsor members an opportunity to meet their friends from other sections of the province, was adjudged a distinct success.

## St. Louis District

J. W. Kelin  
Federated Metals Div.,  
American Smelting & Refining Co.  
Chapter Reporter

ONE OF THE FINEST December parties ever held by St. Louis District A.F.A. chapter took place December 12 at the DeSoto Hotel, St. Louis. Approximately 400 foundrymen and their friends gathered in a gay holiday mood in anticipation of

a fine dinner and a fine show, and they were not disappointed in either.

As the evening wore on, the large audience manifested, by applause, its appreciation of the yeoman service performed the chapter in arrangements for the evening by J. F. Donnell, Hickman, Williams & Co., St. Louis, and the entertainment committee, of which he is chairman.

## Northwestern Pennsylvania

J. E. Gill  
Lake Shore Pattern Works  
Chapter Director

STRICTLY ENTERTAINMENT was the order of the evening for Northwestern Pennsylvania A.F.A. chapter at the Moose Club, Erie, on December 23, as 110 members and guests gathered for the chapter Christmas party.

Chapter Chairman E. M. Strick, Erie Malleable Iron Co., Erie, presided, and W. J. Bartells, of the same firm and chairman of the entertainment committee, piled a five-act entertainment program on top of an opening social hour followed by an "enormous" buffet dinner.

Members of Mr. Bartells' committee, to which is accorded the thanks of the chapter for performance of an outstanding job, are: J. J. Farina, American Sterilizer Co.; Fred Carlson, Griswold Manufacturing Co.; S. R. Stroup, Peerless Mineral Products Co.; Chapter Vice-Chairman J. W. Clarke, General Electric Co.; B. D. Herrington, Hickman, Williams & Co., and Chapter Director J. E. Gill, Lake Shore Pattern Works, all of Erie.

*A "get-together" at the December 6 meeting of Western New York A.F.A. chapter at the Hotel Touraine, Buffalo, N. Y.: left to right, Chapter Vice-Chairman E. R. Jones, Lumen Bearing Co., Buffalo; speaker of the evening S. D. Martin, Central Foundry Div., General Motors Corp., Saginaw, Mich.; technical chairman L. C. Thellemann, Kencroft Malleable Co., Inc., Buffalo; Chapter Chairman H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, and A. M. Clark, Central Foundry Div., who demonstrated core making operations.*



## Toledo

H. G. Schwab  
Bunting Brass & Bronze Co.  
Chapter Director

DR. H. A. SCHWARTZ, National Malleable & Steel Castings Co., Cleveland, was the technical speaker of the evening at the opening meeting of Toledo A.F.A. chapter, October 18 at the Toledo Yacht Club, in that city.

Exceptional attendance, auguring well for the coming season, marked the occasion. Dr. Schwartz drew from his Foundation Lecture of

1945, "Solidification of Metals," for his remarks concerning behavior of pure metals and alloys during freezing, and he illustrated important points with slides.

The chapter members demonstrated their keen interest in the fundamental, yet complex, metallurgical phenomena related to the subject during the general discussion period, when they raised many questions for the attention of the speaker.

### Quad City

C. R. Marthens  
Marthens Co.  
Chapter Secretary-Treasurer

ONE HUNDRED chapter members and guests turned out for the November 18 meeting of Quad City A.F.A. chapter at Fort Armstrong Hotel, Rock Island, Ill., to hear R. W. Paulsen, consultant for the Gray Iron Founders Society, Cleveland, discuss gray iron cost accounting.

### Tulsa

FORMATION OF the 36th chapter of the American Foundrymen's Association, at Tulsa, Okla., moved rapidly toward consummation on December 6, as some 80 foundry-

men held an organizational meeting at the Hotel Alvin, Tulsa; heard A.F.A. Technical Director S. C. Massari explain the purpose, activities and benefits of the Association, and the additional value to members of a local chapter; and unanimously elected a slate of officers to carry through the final steps in chapter organization and to direct chapter activities during the current year.

M. C. Helander, Enardo Foundry & Manufacturing Co., Tulsa, and Chairman of the Steering Committee, which called the organizational meeting, presided; and Paul Coman, Coman Pattern Works, Tulsa, presented the recommendations of the nominating committee, of which he served as chairman.

R. W. Trimble, Bethlehem Supply Co., Tulsa, was named *Chairman* of the new group, with Anton Johnson, Oklahoma Steel Castings Co., of the same city, as *Vice-Chairman*.

C. A. McNamara, Jr., Big Four Foundry, and Frank Lister, Chicago Pneumatic Tool Co., both of Tulsa, were named *Secretary* and *Treasurer*, respectively. It is planned to elect directors at a later date, probably in January, when another meeting is scheduled.

Mr. Massari visited several plants

during his stay in Tulsa, and was assured of the interest of foundries there in the establishment of an A.F.A. chapter. He reported enthusiasm and eagerness to complete final organizational steps and launch a local program among the foundrymen attending the meeting at the Hotel Alvin.

Representation at the gathering was from ten cities: Tulsa, Muskogee, Oklahoma City, Bartlesville, Coffeyville, Blackwell and Enid, Oklahoma; Joplin, Missouri, and Webb City and Wichita, Kansas.

### Cincinnati District

E. F. Kindinger  
Williams & Co.  
Chapter Secretary

EVERY MEMBER had a question to contribute to an unusually lively general discussion period, following the address on "Foundry Practice" presented by F. J. Wurscher, Semet-Solvay Co., Cincinnati, at the November 11 meeting of Cincinnati District A.F.A. chapter in Engineering Society Headquarters, Cincinnati. Some 90 members and guests were on hand for an interesting evening, with Chapter Chairman J. S. Schumacher, Hill & Griffith Co., Cincinnati, presiding.

## FIRST ALL CANADIAN CONFERENCE

February 28-March 1

Royal York Hotel, Toronto

*Sponsored jointly by Eastern Canada-Newfoundland and Ontario A.F.A. Chapters.*

### Friday, February 28th

10:00 am—Registration

10:00 am—Plant Visitations

(Gray iron, malleable, steel and non-ferrous plants  
will be open for inspection)

1:00 pm—Luncheon

(Chapter Officers and A.F.A. Headquarters guests  
will deliver short addresses)

2:30 pm—Plant Visitations

6:30 pm—Main Banquet

SPEAKER, Prof. J. C. Cameron, Queens University, Kingston, Ont.

### Saturday, March 1st

10:00-11:30 am—Group Sessions sponsored by Eastern Canada and Newfoundland Chapter

12:30 pm—Luncheon (Speakers to be announced)

2:30-4:00 pm—Group Sessions sponsored by Ontario Chapter

**January 16**

**Detroit**

Rackham Educational Memorial  
ROUND TABLE DISCUSSION

**Canton District**

Massillon Club, Massillon, Ohio.  
NATIONAL OFFICERS NIGHT  
PROBLEM NIGHT

**January 17**

**Birmingham District**

Tutwiler Hotel, Birmingham, Ala.  
N. J. DUNBECK  
Eastern Clay Products, Inc.  
*How to Select a Bond Clay*

**Western New York**

Buffalo  
ANNUAL STAG PARTY

**January 20**

**Quad-City**

Fort Armstrong Hotel, Rock Island, Ill.  
C. A. SANDERS  
American Colloid Company  
*Foundry Sand Practice*

**January 23**

**Oregon**

Congress Hotel, Portland  
CHARLES SCHUREMAN  
National Lead Co.  
*Sand Control*

**January 24**

**Chesapeake**

Engineers Club, Baltimore, Md.  
ROUND TABLE DISCUSSION

**Texas**

Blackstone Hotel, Fort Worth  
A. C. SINNETT  
Texas Foundries, Inc.

**January 31**

**Ontario**

Royal Connaught, Hamilton  
C. E. BALES  
Ironton Firebrick Co.  
*Crucibles*

**January 27**

**Central Ohio**

Chittenden Hotel, Columbus  
ROUND TABLE DISCUSSION

**JANUARY, 1947**

**CHAPTER MEETINGS**

**JANUARY-FEBRUARY**

**February 3**

**Central Indiana**

Antlers Hotel, Indianapolis  
PROF. M. F. STIGERS  
Purdue University  
*Personnel in the Foundry*

**Chicago**

Chicago Bar Association  
NATIONAL OFFICERS NIGHT

**Central Illinois**

Jefferson Hotel, Peoria  
C. E. BALES  
Ironton Firebrick Co.  
*Modern Foundry Refractories*

**Metropolitan**

Essex House, Newark, N. J.  
ZIGMOND MADACEY  
Caterpillar Tractor Co.  
*Core Blowing*

**February 4**

**Michigan**

La Salle Hotel, So. Bend, Ind.  
W. E. SICHA  
Aluminum Co. of America  
*Applications for Aluminum*

**February 6**

**Saginaw Valley**

Fischer's Hotel, Frankenmuth, Mich.  
R. B. LECKIE  
Chevrolet Grey Iron Foundry Div.,  
General Motors Corp.

**February 7**

**Western New York**

Hotel Touraine, Buffalo  
T. E. BARLOW  
Battelle Memorial Institute  
*Cupola Practice*

**February 10**

**Western Michigan**

Schuler Hotel, Grand Haven  
MORRIS BEAN  
Morris Bean & Company  
*Precision Casting*

**Cincinnati District**

Engineering Society Headquarters  
*Patterns*

**February 11**

**Rochester**

Seneca Hotel  
W. B. WALLIS  
Pittsburgh Lectromelt Furnace Co.  
*Electric Furnace Practice*

**No. Illinois & So. Wisconsin**

Faust Hotel, Rockford, Ill.  
LADIES NIGHT

**February 13**

**Northeastern Ohio**

Cleveland Club, Cleveland  
*Non-Ferrous Melting*

**February 14**

**Texas**

Houston, Texas

**Eastern Canada-Newfoundland**

Mount Royal Hotel, Montreal  
ROUND TABLE DISCUSSION

**Philadelphia**

Engineers Club  
H. H. KESSLER  
Sorbo-Mat Process Engineers  
*Gating and Riser Cast Iron*

**Central New York**

Hotel Onondaga, Syracuse  
PROF. JOSEPH JEFFERY  
Cornell University  
*Metallurgy*

**Twin City**

Curtis Hotel  
K. F. LANGE  
Link-Belt Co.  
*New Foundry Equipment for the Small Foundry*

**COMING FOUNDRY CONFERENCES**

**February 13-14**

**Wisconsin**

Hotel Schroeder, Milwaukee  
TENTH ANNUAL CONFERENCE  
(Complete program, Page 73)

**February 20-22**

**Birmingham District**

Tutwiler Hotel, Birmingham, Ala.  
FIFTEENTH ANNUAL CONFERENCE  
(Complete program, Page 72)

**February 28-March 1**

**Eastern Canada-Newfoundland**

Royal York Hotel, Toronto  
CANADIAN CONFERENCE  
(See adjoining page)

# FOUNDRY PERSONALITIES

**Max Kuniansky**, Lynchburg Foundry Co., Lynchburg, Va., and A.F.A. National Vice-President; A.F.A. National Director **S. D. Russell**, Phoenix Iron Works, Oakland, Calif., and **E. C. Hoenicke**, Eaton Manufacturing Co., Detroit, who serves as a director of Detroit A.F.A. chapter, were named directors of the Gray Iron Founders' Society at the recent annual convention of the trade association. The society elected **H. A. Stockwell**, Barbour-Stockwell Co., Cambridge, Mass., as president; **R. E. Kucher**, Olympic Foundry Co., Seattle, vice-president; **E. B. Smith**, American Brake Shoe Co., New York, secretary, and **Homer Britton**, Cleveland Foundry Co., Cleveland, treasurer.

**F. R. Lack**, vice-president, Western Electric Co., will serve as president, American Standards Association, New York, to which office he was elected at the annual meeting of the association at the Waldorf-Astoria, New York. **Howard Coonley**, chairman, executive committee, American Standards Association, was elected president of the new International Organization for Standardization, following its recent formation by delegates of 25 nations meeting in London.

**J. A. Payne**, president, Consolidated Coppermines Corp., was recently elected chairman of the board, Titan Metal Manufacturing Co., Bellefonte, Pa., in which controlling interest is now held by the Consolidated firm. New directors are **C. D. Tripp**, Chicago, also a director of Consolidated Coppermines Corp., and **E. N. Hickman**, vice-president, American Metal Co. Ltd., New York.

**F. B. Nimick** was elected to the board of directors, Vanadium-Alloys Steel Co., Latrobe, Pa., at a recent meeting. Mr. Nimick, who fills the vacancy created by the death of **T. H. Childs**, has been associated since 1913 with the Colonial Division of the firm, at Monaca, Pa., which was founded by his father as the Colonial Steel Co.



Oscar Blohm



Max Kuniansky

**Oscar Blohm**, formerly chief metallurgist, Hills-McCanna Co., Chicago, is now co-owner, with **Marshal King**, formerly foundry superintendent with the Hills-McCanna firm, of Triangle Foundry Co., Chicago. In the Triangle organization, Mr. Blohm will serve as secretary-treasurer; Mr. King, as president. An A.F.A. member, Mr. Blohm serves currently as a director of Chicago chapter, and as a member of the Program and Papers Committee, A.F.A. Aluminum and Magnesium Division.

**F. P. Schneider**, secretary and treasurer, Velsicol Corp., Chicago, since founding of the firm in 1931, became president and general manager in an election at a recent special meeting of board of directors.

**Thomas Cruthers**, vice-president, Worthington Pump & Machinery Corp., Harrison, N. J., was recently named a director of that firm's subsidiary, Electric Machinery Mfg. Co., Minneapolis.

**F. X. Karle**, associated with Aluminum Industries, Inc., Cincinnati, since 1924 and elected a director of that firm last September, recently assumed the position of treasurer. He succeeds in that office **H. J. Hater**, who continues as president and general manager.

**Pierre and Francois Collignon**, operators of three foundries, one malleable and two gray iron, in France, were recent distinguished visitors to the A.F.A. National Office. Messrs. Collignon are engaged in a study of modern American methods and have visited a number of American plants recently.

**J. S. Csaklos**, for the past 18 years foundry superintendent, Reading Steel Casting Div., American Chain & Cable Co., Reading, Pa., recently joined Hartford Electric Steel Corp., Hartford, Conn., as works manager. He will be in full charge of all foundry and production operations. Mr. Csaklos, an active member of A.F.A. and Steel Founders Society, includes in his extensive background experience as plant superintendent at Sterling Steel Casting Co., East St. Louis, Ill., and Sivyer Steel Casting, Milwaukee.

**R. R. Deas, Jr.**, works manager, American Cast Iron Pipe Co., Birmingham, Ala., and associated with that firm since 1914, has joined **Lester B. Knight & Associates**, Chicago, as survey engineer in foundry modernization programs. **B. J. McGarry**, formerly president, Industrial Management Engineering Co., Cleveland, has joined the Knight firm as senior industrial engineer, specializing in management and engineering for foundries.

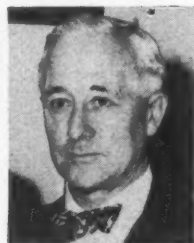
**Frank Best** has been advanced to works manager, and **Robert Tetzlaff** to foundry foreman, in promotions announced by Western Alloyed Steel, Minneapolis.

**Jack Rhodes**, formerly with Donovan Manufacturing Co., Winona, Minn., has moved to Minneapolis-Moline Power Implement Co., Minneapolis, as assistant foundry superintendent.

**Dr. W. A. Johnson**, manager metallurgical section, Westinghouse Research Laboratories, Pittsburgh, Pa., has been selected to set up and direct a new metallurgical division of the Clinton laboratories at Oak Ridge, Tenn. Dr. Johnson, who holds the degrees of Bachelor of Science, Lehigh University, Bethlehem, Pa., and Doctor of Science, Carnegie Institute of Technology, Pittsburgh, has been granted a leave of absence by his firm and is already at work on his new task. He has been associated with the Westinghouse organization since 1939.

AMERICAN FOUNDRYMAN

**R. C. Tiplady**, who returned to the publishing field recently as editor, *Canadian Metals and Metallurgical Industries*, Toronto, following war-time service with the R. C. A. F., has been appointed director of publicity for Ontario A.F.A. chapter. Mr. Tiplady has long been interested in the activities of technical associations and, prior to the war, was active in ASM and SAE, as well as A.F.A.



**P. C. Valentine, Jr.** **P. C. Valentine, Sr.**

**P. C. Valentine, Jr.**, with the Army Air Corps during the war, recently joined the sand department, Del Monte Properties Co., San Francisco, as assistant to his father, **P. C. Valentine, Sr.**, sales manager of the department for the past 17 years and associated with the firm since 1924. Mr. Valentine, Sr., a member of Northern California A.F.A. chapter and long popular with foundrymen for his guitar and singing performances at their gatherings, will have an able assistant in his son, who is also an accomplished musician.

**F. J. Kohut**, sales manager and chief of development, C. M. Kemp Manufacturing Co., Baltimore, Md., was advanced recently to the overall post of general manager, according to announcement by the firm.

**K. E. Rose**, research engineer, Battelle Memorial Institute, Columbus, Ohio, moved recently to the University of Oklahoma, Norman, as assistant professor of mechanics and metallurgy.

**R. A. Wahl**, who has served in purchasing and sales capacities with Union Steel Castings Div., Blaw-Knox Co., Pittsburgh, since 1937, has been appointed sales manager.

**P. R. Pollock** has been named manager of the Denver, Colo., of-

rice, Allis-Chalmers Manufacturing Co., Milwaukee, succeeding **H. H. Roth**, who joins the generator sales section of the firm at the main works, West Allis, Wis.; **A. R. Knauss**, formerly of the Tulsa, Okla., office, moved to Memphis, Tenn., as manager; **C. F. Codrington**, advanced from assistant manager to sales manager, blower and compressor department at Milwaukee, succeeding **A. E. Caudle**, resigned, and **Howard Hansen**, who has been in the administrative office of vice-president **W. C. Johnson**, appointed supervisor, office of **J. L. Singleton**, manager of district offices, Milwaukee.

**B. P. Mulcahy**, for the past 11 years research engineer, Citizens Gas & Coke Utility, Indianapolis, announces the opening of his own offices, at 3825 Arthington Blvd., Indianapolis, as an engineering consultant on cupola operation and coal carbonization. Author of several papers on foundry coke, Mr. Mulcahy also has been identified with the Cupola Research Project and assisted in the preparation of the *HANDBOOK OF CUPOLA OPERATIONS*, especially those sections concerned with fuel. He has served as Chairman, and as a Director of Central Indiana A.F.A. chapter, and is a popular speaker before Association meetings. His technical activities



**B. P. Mulcahy**

include committee work, speaking and preparation of papers for American By-Product Coke Institute, American Gas Association, Blast Furnace and Coke Oven Association, and American Society for Testing Materials. Mr. Mulcahy is a graduate chemical engineer from the University of Illinois, Urbana, and, prior to joining the Citizens firm, was with Associated Gas & Electric Co., Geneva, N. Y., as

chemical engineer, and with Indiana Gas & Chemical Corp., Terra Haute, Ind., as chief chemist.

**R. F. Hilbert** has been appointed sales agent in the Rochester, New York, area for Vascoloy-Ramet Corp., North Chicago, Ill.

**F. K. Landgraf, Jr.**, released from specialist service with the Air Corps, joined the research facilities of **Carl A. Zapffe**, consulting metallurgist, Baltimore, Md., recently. Prior to his service career, Mr. Landgraf was associated with research work at Vanadium Corp. of America and Lebanon Steel Foundry, Lebanon, Pa.

**G. W. Altman** joins the foundry staff of Lennox Furnace Co., Columbus, Ohio. He was associated with Pittsburgh Coke & Iron Co., Pittsburgh, prior to service with the Army, from which he was recently released.

#### Obituaries

**George O. Forbes**, chairman of the board, Gunitite Foundries Corp., Rockford, Ill., died December 8 at his home in North Egremont, Mass. He was 72.

A native of Rockford, he attended public schools there and later received his college education at Princeton University. One of three grandsons of Duncan Forbes, who founded Rockwell Malleable Iron Works, predecessor to Gunitite Foundries Corp., **George O. Forbes** was the third generation associated with the firm: He was an uncle of **Duncan P. Forbes**, president, Gunitite Foundries Corp., and past A.F.A. National President.

**Roy R. Arnold**, division sales manager, Michigan Smelting & Refining Div. and Aluminum Refiners Div., Bohn Aluminum & Brass Corp., Detroit, died December 31.

Associated with the Michigan Smelting & Refining organization since 1914, Mr. Arnold was its representative in participation at A.F.A. conventions and exhibits for many years. He was also active in committee work and other undertakings of Detroit A.F.A. chapter, and his loss will be keenly felt by his many friends in the Association, as well as throughout the foundry industry.

## NEW LITERATURE

Testing for "Rockwell Hardness" with the "Clark Hardness Tester" is described in a 20-page, well illustrated booklet, presented by Clark Instrument, Inc., 10200 Ford Road, Dearborn, Mich. Included are discussions of construction details of the units; specifications; fundamental data on hardness testing, and recommendations concerning accessories.

Fundamentals of operation, application, advantages and specifications of a new 12-equation electrical computer for solving simultaneous linear equations, are given in a 4-page brochure offered by Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Calif.

Newest and smallest model of the "AM Sandcutter," produced by American Foundry Equipment Co., Mishawaka, Ind., is presented in a 12-page catalog, No. 25A, available from the firm. Construction details and features are discussed and pictured; complete specifications and general dimensions presented; and typical installations shown.

Facilities of a modern, mechanized brass foundry are toured in a recent issue of "The Faucet," published by H. B. Salter Mfg. Co., Marysville, Ohio. Illustrations and text are concerned with installations, methods and products of expanded facilities for production of plumbing fixtures.

New aluminum alloy, for which strength approximating that of malleable iron is claimed, is described in a recent bulletin by Acme Aluminum Alloys, Inc., Dayton 3, Ohio. Composition and physical properties are given, and typical castings pictured.

Bulletin No. 124-F, of Robins Conveyors, Inc., Passaic, N. J., describes and illustrates the "Robins Portable Floatex Shakeout," equipped with an automatic flask loader for lifting flasks from foundry floor, turning

them upside down on the shakeout machine, shaking out sand and discharging castings. Also discussed is the "Robins Mold Set-Down Machine," designed for handling of heavy molds with an actual weight-lifting requirement of only ten pounds on the part of the molder.

Carbide-tipped drills for use on concrete, tile, porcelain, slate, brick and masonry, are described in a 4-page color bulletin issued by Metro Tool & Gage Co., 4240 W. Peterson Ave., Chicago 30. Specifications, prices and applications are listed.

Malleableizing iron castings with the "Wilson Rectangular Bell Type Furnace" is discussed in a bulletin just issued by Lee Wilson Engineering Co., Inc., Cleveland 16. Typical installations are shown, and production data and operating details given.

Fast and economical removal of sprues from non-ferrous castings is the purpose of the "Crescent Sprue Saw," described in Bulletin No. 4, issued by Crescent Machine Co., Leetonia, Ohio. Bulletin No. 7, issued by the firm describes disc sanders for the modern industrial pattern shop; and a number of other 4-page booklets are available, concerned with modern woodworking machinery such as planers, saw tables, shapers and mortisers. Units are described and shown, and complete specifications given.

Gas, arc and resistance welding, and brazing and soldering of aluminum, are described and shown in the new 88-page, ring-bound book, "Welding Aluminum and Aluminum Alloys," issued by Reynolds Metals Co., Louisville 1, Ky., and designed to bring users of aluminum a comprehensive review of latest practices and recommendations for joining aluminum by these processes. Factors affecting weldability of the more commonly used aluminum alloys are discussed briefly in

the introduction after which the various methods are analyzed, described in detail and illustrated. The book is available at \$1.00 per copy.

Wet and dry units, designed to provide versatile accommodations for processing moderate amounts of photographic materials, are described in a new pamphlet available from the Sales Service Division, Eastman Kodak Co., Rochester 4, N. Y. The 4-page brochure, "Plans for Darkroom Workbench and Sink Units," lists pertinent points to be remembered in construction of such equipment, and incorporates design drawings. Punched to fit the Kodak Photographic Notebook.

A compilation of various specifications issued by government agencies and metallurgical societies on standard brass, bronze and aluminum alloys and fabricated shapes, is presented in the third edition of the "Non-Ferrous Specifications Handbook," published by North American Smelting Co., Philadelphia 4. Fundamental metallurgical and foundry data and a collection of reference tables are also included in the 114-page book. Loose-leaf format provides for future revisions and additions.

A handy slide-rule type melting point indicator for tin-lead solder, and wire gauge comparer (reverse side), is available from Federated Metals Div., American Smelting & Refining Co., New York 5.

"Reynolds Aluminum Alloy Selector," a slide-rule type of chart, 8½x11 in., presents in handy form, data on mechanical properties, chemical composition, physical constants, thermal treatments and specifications, for 18 popular aluminum alloys. Two slides are used: One lines up with the alloy designation; and the chart shows chemical composition in 12 elements; physical constants, and recommended maximum forging temperature, solution and precipitation heat treatment

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and annealing cycles. Second slide lines up with one of seven products forms desired (sheet, plate, rod, etc.); and chart shows tempers available; ranges of tensile strength, yield strength, hardness and elongation; and comparable ASM, ASTM, Federal and Navy specifications. Available from Reynolds Metals Co., Louisville 1, at \$1.00 each.

Safety equipment against a wide variety of industrial hazards is detailed in the "Davis Protection Catalog," a 94-page booklet available through Davis Emergency Equipment Co., Inc., 201 N. Wells St., Chicago 6. Supplies for first aid, respiratory protection, electrical safety and personal protection, as well as combustible gas indicators and other Davis instruments are considered; and a price list is inserted.

Featuring a series of "thumbnail buying guides," a new 16-page, generously illustrated bulletin, just released by Allis-Chalmers Mfg. Co., Milwaukee, is designed to help the processor select equipment to fit his requirements from the range of industrial products offered by the firm. Ask for Bulletin 25B6177B.

In a new, profusely-illustrated booklet of 20 pages, the Foundry Div., Eaton Mfg. Co., Detroit 3, presents the story of production of permanent mold gray iron castings. Procedure used in production of molds and the process casting, are shown in detail; and discussions of physical and mechanical properties of permanent mold gray iron, together with suggestions for designing products for the process, are included.

Precision casting methods, advantages, limitations, etc., are the subject of an informative bulletin, 19B6451, just issued by Allis-Chalmers Manufacturing Co., Milwaukee. Also available from the firm are: Bulletin 14B6641, a 12-page engineering booklet explaining remote indicating and control systems, what they are and what they are capable of accomplishing, and a 16-page booklet designed for student training, explaining the "A-B-C" of Allis-Chalmers turbo-blowers, rotary com-

pressors and vacuum pumps through clever, simplified illustrations and reproductions of pressure, influence of water volume and correction curves.

A method for positioning and holding benchwork, applicable to patternmaking, grinding, welding, etc., is described and illustrated in detail in a folder of descriptive literature on "Powrarm" positioning equipment, offered by Garfield Engineering Corp., Kansas City 5, Mo.

Information on "Frequency Relay Magnetic Control" for A-C wound rotor, motor-operated cranes, is presented in Bulletin 930, offered by Electric Controller & Manufacturing Co., 2700 East 79th Street, Cleveland 4. Complete description of the firm's products and tables on ratings, dimensions, etc., are included.

In a new 32-page booklet, illustrated in full color, E. I. du Pont de Nemours & Co., offers "Du Pont Color Conditioning for Industry," and makes clear the fundamental principles upon which color conditioning is based. Available from the firm's Finishes Division, Wilmington 98, Del.

"A.B.C. Suggestions," comprising a series offered by American-British Chemical Supplies, 180 Madison Avenue, New York, contain information not usually covered in text books and relating to various branches of the metal field. Included are recommendations on the melting and casting of aluminum, gray iron, steel, brass and tin bronze alloys, and on core coatings and washes.

Correct principles of sharpening twist drills are detailed in a new manual, "G-1," issued by Republic Drill & Tool Co., 322 S. Green St., Chicago 7. Recommendations on the proper care of twist drills and pointers on sharpening, web thinning and proper dimensions and angles of points for best results, are included in the 24-page booklet. Bulletin RM-1, also available from the company, gives complete information on its new line of "Mechanic Length" drills, designed for longer wear and

faster feeds through shorter length and sturdier over all construction.

Release of a new reference booklet on "Aluminum Casting Alloys" has been announced by Federated Metals Div., American Smelting & Refining Co., New York. Chapters of the 44-page, well illustrated booklet are concerned with fundamental information on the effect of copper, silicon, magnesium, etc., as well as with heat treatment, ageing, laws of gas absorption, degassing, cracks, shrinkage and dross, and other valuable technical data about specifications, mechanical properties and foundry characteristics.

Physical, chemical, mechanical and electrical properties of more frequently used aluminum-silicon-magnesium ceramic compositions, are presented in convenient form in the "AlSiMag Property Chart," available from American Lava Co., Chattanooga 5, Tenn., which produces a wide range of ceramic products custom made to specifications of individual firms. The research division of American Lava Co. offers data concerning compositions for specific applications too numerous to include in the chart.

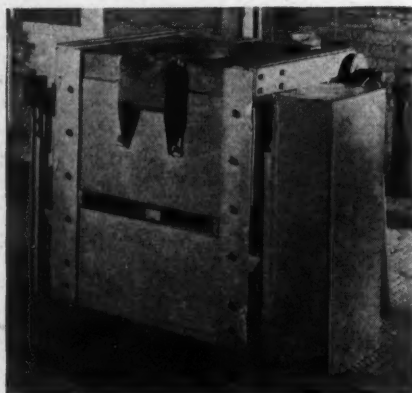
Process engineers and power men can find nine case histories of fuel cost savings through proper insulation of hot surfaces in a 20-page manual, "Control of Industrial Heat and Power Losses," prepared by the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17. Typical applications are described, and formulas for computing heat losses, tables of necessary data for use with the formulas, as well as a "Heat Loss Estimate Sheet," are incorporated.

Technical data on high silicon pig iron for the foundry are presented in a 24-page, ring-bound booklet, "Electro-Silvery," offered by Electro-Metals Co., Keokuk, Iowa. Special methods of processing and casting "Keokuk Electro-Silvery" and applications of that high silicon pig iron, are described and shown. Included in the large number of illustrations are reproductions of seven beautiful oil paintings.

# NEW PRODUCTS

## Electronic Foundry Equipment

*Allis-Chalmers Manufacturing Co.*, Milwaukee, announces the application of electronic frequency converting equipment to the melting of alloy steels in the foundry. Mercury arc converters as frequency changer units for converting three-phase, 60- or 25-cycle power into single-phase, 1000-cycle current, have been previously used only for forging or melt-



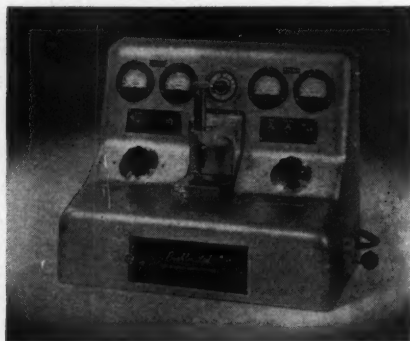
ing of non-ferrous metals. The Allis-Chalmers installation, comprised of a 300-kw electronic frequency changer, to which three-phase power is supplied through a standard metal-enclosed oil circuit breaker at 6900 volts, and two induction melting furnaces receiving high frequency power at 880 volts, melts the steel for the foundry in approximately 45 minutes. Furnaces have a capacity of 650 lb. each, with provision for substituting coils capable of 1000 lb. in the future.

## Abrasive Wheel

*Norton Co.*, Worcester, Mass., reports that field tests have shown its



new "32 Alundum" grinding wheels to be especially effective for snagging castings with portable grinders. The new aluminum oxide abrasive of which the wheels are made in a unique electric furnace process, which produces grains as complete single crystals, is said to have definitely faster and cooler cutting action and longer life. Crystals of the aluminum oxide assume a chunky, nubby shape as they form, and the many plane surfaces, forming exterior and reentrant dihedral angles, are credited with improving cutting efficiency.



## Specimen Polisher

*Buehler, Ltd.*, 165 W. Wacker Drive, Chicago 1, claims greater polishing speed and simplicity of operation for its new "Buehler-Wiasman Electro-Polisher," for use with ferrous and non-ferrous metals and accommodating a wide range of specimen sizes. Operation is reported economical, requiring only a small amount of the non-explosive solution; mechanical operation is extremely simple. The specimen is fitted over a small opening in a stainless steel tank containing the electrolyte, the tank is tilted down, bringing the fluid into contact with the sample, and the latter is made the anode of an electrolytic cell.

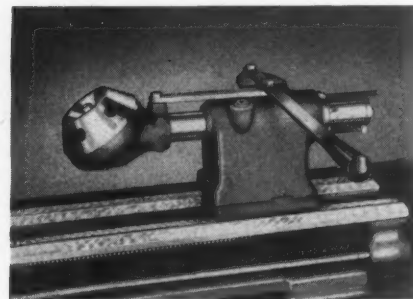
## Molding Alloy

*Trethaway Associates*, 37 Wall Street, New York, offers "Mold-alloy" for casting wax molds for the precision casting process, forming dies for thin sheet metals, proof

castings of molds, etc. The alloy melts at 430 degrees F, has 22 Brinell, 8,000-lb. per square in. compression strength, 11,500 lb. per square in. tensile strength, and shrinkage of approximately 0.001 in. per inch.

## Lathe Turret

*South Bend Lathe Works*, 91 East Madison St., South Bend 22, Ind., has designed a new tailstock-type "Handlever Turret" for use on its 9-in. precision lathes, to give turret lathe efficiency on jobs requiring a number of successive operations. The six-station unit mounts on the inside ways in place of the tailstock, accommodates tools with 5/8-in. diam-



eter shanks. Length of cut at each station is regulated by adjustable set screw. Turret slide has maximum stroke of 3/4-in., and operations can be repeated or skipped at will.

## Intercommunication Unit

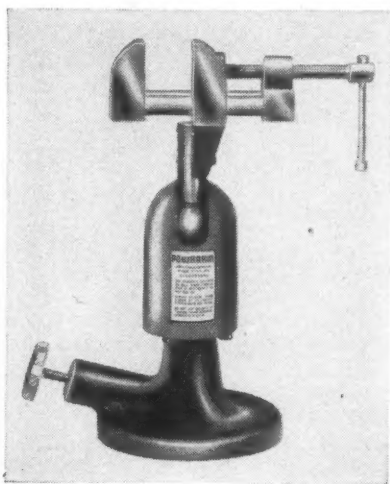
*Executone, Inc.*, 415 Lexington Ave., New York 17, has recently introduced new dust and moisture proof, metal-housed industrial type intercom staff stations, suitable for use in foundries and many other locations. Concealed terminals, built inside the cabinet, permit safe and positive wiring connections. Units can be wired directly to any "Executone Central Control Master Station," and are available in two models: remote control, C-22, permitting user to receive a call and reply from a distance of approximately 20 ft. without approaching the station,

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and the privacy model, C-26, equipped with a toggle switch for call origination and assuring freedom from eavesdropping when in idle position.

### Work Positioner

*Garfield Engineering Corp.*, Kansas City, Mo., is in mass production with its new "Powrarm Universal Positioner," designed to save many man-hours in manufacture, maintenance, assembly or repair, through enabling the workman to position rapidly and hold securely all types of bench work, while having both hands free for operations. Pressure control knob permits adjustment and locking by fingertip control; the unit



permits ready access to all sides of the work, and fatigue and hazard of injury or damage are reduced. The positioner holds light or heavy work and permits turning 360 degrees at any angle or in horizontal or axial planes, and 180 degrees in vertical planes.

### Industrial Truck

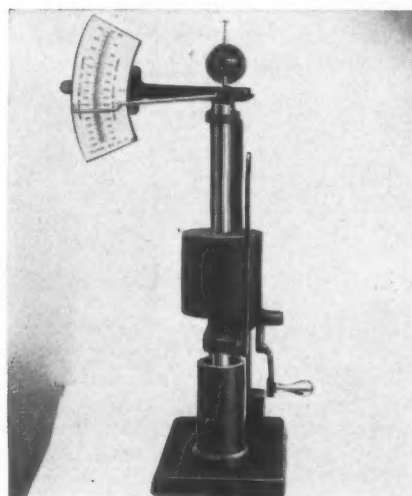
*Automatic Transportation Co.*, 149 W. 87th St., Chicago 20, offers a modified version of its standard fork truck, equipped with hydraulic "pincers" in place of the regular forks, which handles light and bulky cartons as unit loads without pallet or skid. Clamping pads, adjustable in height, are mounted on a scissors-like frame opened by a hydraulic pump; release of the hydraulic pressure allows springs to pull the clamps together, securing the load. As



shown in cut, the device is installed on a 2000-lb. capacity telescopic and tilting unit.

### Density Indicator

*Harry W. Dietert Co.*, Detroit, has developed a unit for determination of the weight of molding sand, in pounds per cubic foot, for any degree of ramming compactness that may be chosen or under an A.F.A. standard sand specimen degree of



ramming. The density indicator may be attached to any A.F.A. sand rammer by means of two screws, and does not interfere with functions of the latter. A known weight of molding material is placed in a 2-in. diameter specimen tube and rammed; the density indicator shows the weight in pounds per cubic foot for that material rammed to that specific hardness. Daily records may be kept of exact weight of sand as used in the foundry, through use of the new unit.

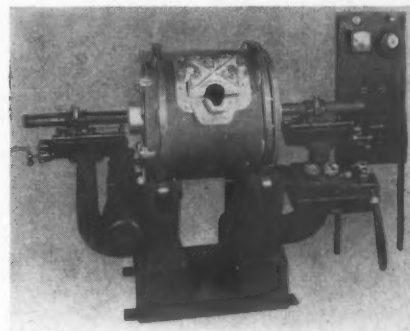
### High Speed Alloy

*Vanadium-Alloys Steel Co.*, Latrobe, Pa., presents a new high

speed steel, "Vasco Supreme," with carbon content higher than heretofore produced and said to give performance greatly superior to generally used tool steels. Said to permit operating speeds 15-100 per cent above those in common use with other tool steels, the alloy contains 5 per cent vanadium, to prevent brittleness and increase hardness, and cobalt, to improve "hot hardness" properties. It has been found valuable in machining iron and cast steels, and is reported to be of high edge strength, with ample toughness for all applications, including intermittent cutting, due to carbon-vanadium balance.

### Electric Arc Furnace

*Detroit Electric Furnace Div., Kuhlman Electric Co.*, Bay City, Mich., features simplified change of shells to permit melting a wide variety of ferrous and non-ferrous alloys in its new indirect arc rocking furnace, "Type LF." Rated at 100



kw. with 200-lb. nominal cold charge capacity, the furnace has non-rotating graphite electrodes supported by stationary brackets. Withdrawal of electrodes permits removal of melting chamber without detaching brackets. Typical energy consumption over a nine-hour day is reported as 318 kw. hr. per ton for red brass.

### Hose Coupling

*Hose Accessories Co.*, 2702-P North 17th Street, Philadelphia 32, presents the "LE-HI Series 150-B" hose coupling, featuring a simple, built-in locking device, to provide maximum safety for workers using high-pressure air hose lines and instant and easy engagement and disengagement.

# ABSTRACTS



NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications. When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th St., New York, N. Y.

## Aluminum-Base Alloys

**HEAT TREATMENT.** Rowe, H. J. and Sicha, "Cast Aluminum Alloys—Heat Treatment," *AMERICAN FOUNDRYMAN*, August, 1946, vol. 10, no. 2, pp. 30-41.

A description of heat treating processes, and changes which take place in metal structure and properties.

**NITROGEN FLUSHING.** Baak, A. C. and Allen, G. A., "Flushing Aluminum With Nitrogen Gas," *CANADIAN METALS AND METALLURGICAL INDUSTRIES*, September, 1946, vol. 9, no. 9, pp. 16-21, 39.

A series of tests indicating the possibilities of the use of nitrogen gas as a flux for aluminum.

**SAND AND PERMANENT MOLD CAST.** Klayer, Walter J., "Sand Cast and Permanent-Mold Cast Aluminum Alloy Parts," *PRODUCT ENGINEERING*, October, 1946, vol. 17, no. 10, pp. 81-85.

A comparison of physical properties, relative costs, and production rates of castings made by either sand casting or permanent-mold casting.

## Cast Iron

**PROPERTIES.** Flinn, R. A. and Chapin, H. J., "White and Gray Irons—Ductility and Elasticity," *AMERICAN FOUNDRYMAN*, August, 1946, vol. 10, no. 2, pp. 47-59.

Although popularly considered brittle materials, white, mottled and gray irons can be manufactured with definite elasticity and ductility as well as reproducible tensile strength and other properties. As the matrix structure changes from pearlitic to austenitic, the plastic elongation changes from 0.0000 to 0.0500 per cent in white and mottled irons and from 0.05 to 3.0 in gray iron. Ferritic-pearlitic gray irons exhibit up to 1.0 per cent elongation. Modulus of elasticity varies from 26.0 to  $10.4 \times 10^4$  psi depending upon structure.

## Centrifugal Casting

**GERMAN DEVELOPMENT.** "Centrifugal Casting in Germany," *STEEL*, October 21, 1946, vol. 119, no. 17, pp. 100-101, 130, 132.

The status of centrifugal casting in Germany on V-E Day.

## Chemical

**POLAROGRAPHIC.** De Paola, F. R., "Polarographic Analysis of Zinc in Aluminum Alloys," *THE IRON AGE*, October 3, 1946, vol. 158, no. 14, pp. 36-40.

Use of the polarographic method in the quantitative analysis of zinc in aluminum alloys has reduced the analysis time as compared with chemical and spectrographic methods. A detailed description of the materials and apparatus used, is presented, as well as a step-by-step description outlining the procedure to be followed in the mathematical solution.

## Chemical Analysis

**ALUMINUM DETERMINATION.** Weissler, Alfred and White, Charles E., "Fluorometric Determination of Aluminum in Steels, Bronzes, and Minerals," *INDUSTRIAL AND ENGINEERING CHEMISTRY*, September, 1946, vol. 18, no. 9, pp. 530-534.

A rapid fluorometric method is described for the quantitative determination of from 0.001 per cent to somewhat over one per cent of aluminum in steels, bronzes, and minerals.

## Copper-Base Alloys

**BRONZE.** Roast, Harold J., "Bronze Castings," *CANADIAN METALS AND METALLURGICAL INDUSTRIES*, October, 1946, vol. 9, no. 10, pp. 25-28.

Questions and answers on materials and methods.

**TIN BRONZES.** Winterton, K., "Chill-Cast Tin Bronzes," *METAL INDUSTRY*, October 11, 1946, vol. 69, no. 15, pp. 297-299.

The effect of the addition of 2.5-10 per cent zinc on the casting characteristics, and mechanical and physical properties of chill-cast tin bronzes (5-15 per cent zinc).

## Furnaces

**HEAT TREATING.** Paschkis, Victor, "Heat Treating Furnaces," *AMERICAN*

*FOUNDRYMAN*, August, 1946, vol. 10, no. 2, pp. 81-87.

Classification of furnaces, furnace temperatures, heating rate, furnace and storage space, cost comparison, rate of heat loss, furnace types compared, heating uniformity.

## Gating and Riser

**EXOTHERMIC MATERIALS.** Lutts, C. S., Hickey, J. P., and Back, Michael II, "Exothermic Materials," *AMERICAN FOUNDRYMAN*, August, 1946, vol. 10, no. 2, pp. 71-76.

Exothermic materials in concentrated form, used as riser additions, provide the heat necessary for proper directional solidification in the casting, reducing riser size and increasing yield.

## Gray Cast Iron

**SPECIFICATIONS.** Geist, K. R., and Hambley, W. A., "A Practical Method of Specifying Cast Irons," *THE IRON AGE*, October 31, 1946, vol. 158, no. 18, pp. 46-49.

A simple, practical method for specifying grades of cast iron for specific applications. The method employs a simple code which enables a design engineer to quickly and accurately select the grade of iron with the desired characteristics, taking into consideration strength and hardness in the controlling section size.

## Heat Resistant Alloys

**HIGH STRENGTH.** Wilson, Thomas Y., "High Strength, High Temperature Alloy S-816," *MATERIALS AND METHODS*, October, 1946, vol. 24, no. 4, pp. 885-90.

Chemical composition, method of testing, heat treatment, fabrication and applications of a precision casting alloy having high strength at 1500° F., resistance to burned fuel gases and ease of fabrication.

**STEELS.** Dobkin, Herbert, "Functions of Alloying Elements in Heat Resisting Steels," *STEEL*, October 28, 1946, vol. 119, no. 18, pp. 78-79, 106, 108, 111.

Fundamentals of the metallurgy of heat resistant alloys.

## Magnesium-Base Alloys

**DESIGN AND APPLICATIONS.** Gray, Allen G., "Magnesium and Magnesium Al-

(Concluded on Page 87)

## Abstracts

(Continued from Page 84)

loys," STEEL, October 21, 1946, vol. 119, no. 17, pp. 92-96, 112, 115-116.

Production costs, fabrication plants, magnesium alloys, design considerations, castings, forgings, sheet and structural shapes.

### Malleable Cast Iron

CORES. Clark, Joseph L., "Malleable Foundry Core Sand Practice," AMERICAN FOUNDRYMAN, August, 1946, vol. 10, no. 2, pp. 61-69.

Selection and control of new sands; sand drying; fines removal; selection, storage, and control of other raw materials; core sand mixing equipment, mixtures and mixture control; coremaking equipment; and core baking.

### Metallurgy

GAS REMOVAL. Hume, P. M., "Removing Dissolved Gases," STEEL, October 7, 1946, vol. 119, no. 15, pp. 108-111, 160, 163; October 14, 1946, vol. 119, no. 16, pp. 110-111, 122, 125-126, 128.

An efficient and economical method of removing harmful gases from molten metals, known as "flushing," consists of bubbling a dry inert gas through the metal just before casting. Dissolved gas passes from solution by diffusion into rising bubbles and is carried out of metal mechanically.

Five types of flushing gas employed for producing artificial boil of molten metal are described.

### Non-Destructive Testing

METHODS. Le Grand, Rupert, "Non-Destructive Testing Methods," AMERICAN MACHINIST, May 23, 1946, pp. 119-142.

Radiographic inspection, fluoroscopic inspection, magnetic particle inspection, supersonic inspection, thickness gages, film thickness gages, spectrographic examination, and magnetic analysis inspection.

### Non-Ferrous

SKIMMER SCREENS. Myskowski, E. T. and Taylor, H. F., "Skimmer Screens for Non-Ferrous Castings," AMERICAN FOUNDRYMAN, August, 1946, vol. 10, no. 2, pp. 24-29.

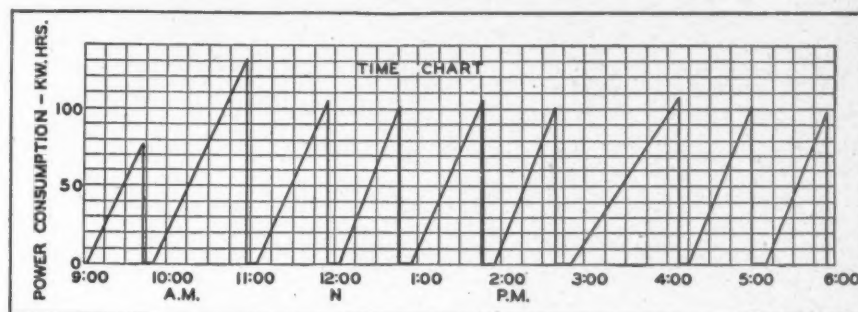
Defects caused by dirt can be largely eliminated in copper-base alloy castings by the use of perforated steel sheets. Inserted in the in-gate of the mold, the screen prevents dirt and dross from entering the mold cavity. Cleaning costs can be reduced by insertion of the screen in the mold cavity at the junction of risers and casting.

JANUARY, 1947

## DAILY OPERATING RECORD OF SMALL DETROIT ELECTRIC FURNACE MELTING GREY IRON



DAILY GRAPHIC OPERATING RECORD, TYPE LFC, 350 LB. DETROIT ROCKING ELECTRIC FURNACE, MELTING HIGH QUALITY GREY IRON FOR CYLINDER LINERS.



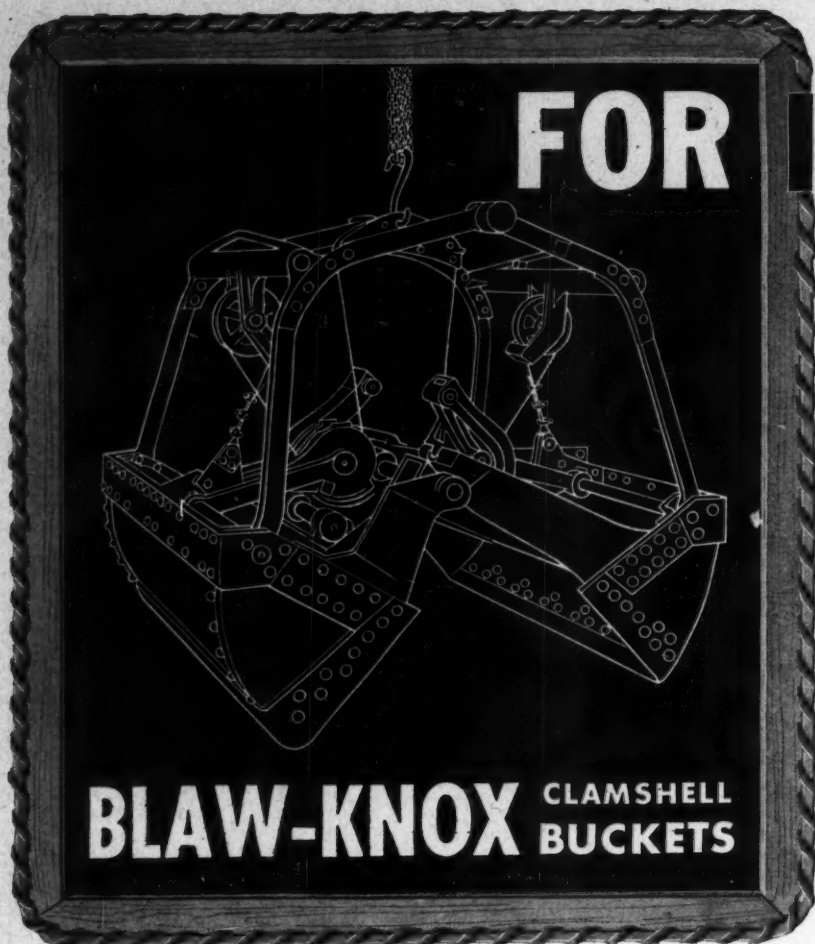
SUMMARY: HOURS OPERATION 9; NO. HEATS, 8; WT. PER HEAT, 375 LBS.; TOTAL METAL MELTED, 3000 LBS.; KWH TOTAL, 931; KWH PER TON, 620.

Let's take a look at the facts from the daily operating record of a Detroit Rocking Electric Furnace covering a 9-hour working day.

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Records like this are incontrovertible evidence that Detroit Electric Furnaces are fast melting, economical, efficient. They are your assurance that Detroit Electric Furnaces, installed in your own foundry, will do a faster, more versatile job of melting ferrous and non-ferrous metals. Write for further facts.

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## American Foundrymen's Association

222 West Adams Street

Chicago 6, Illinois

## Convention

(Continued from Page 23)

extend over the entire convention with a session on each day as follows: April 28, malleable iron; April 29, non-ferrous; April 30, steel; May 1, gray iron.

### Papers

In accordance with the new, and previously announced intention of preprinting all convention papers in advance of the Annual Meeting, authors are sending their papers in for approval prior to the January 15 deadline. The requirement is expected generally to better materially the quality of all papers to be presented, and to avoid presentation of papers which have not been preprinted and distributed to the membership for discussion purposes.

A wide variety of subjects is being offered in 1947, especially in the Gray Iron, Sand, and Aluminum and Magnesium divisions. Those active on the program of papers have urged all authors to comply with the January 15 deadline if at all possible.

### Housing

As previously announced, hotel application blanks have now been mailed to all A.F.A. members, who are urged to forward applications direct to 1947 Convention Housing Bureau, 1005 Stroh Building, Detroit 26, Mich. Naturally, members of A.F.A. are being given first call on the hotel rooms guaranteed by the Detroit Hotel Association, and this year assignment will begin not earlier than February 15.

If you have not yet sent in your hotel application form, please do so immediately. The assigning of rooms can be materially simplified if the requirements of each company are covered on one application. Since 1947 is a non-exhibit year, it is expected that a majority of available hotel rooms will be assigned to foundrymen and those participating actively in the technical sessions and other program events.

### Hosts

The Detroit Chapter of A.F.A., headed by Chapter Chairman A. H. Allen of Penton Publishing Co., has appointed a number of Convention Committees who will act as hosts

(Continued on Page 90)

JANUARY, 1947

# "IT'S REALLY PORTABLE!"

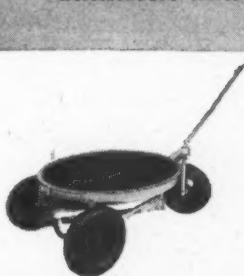
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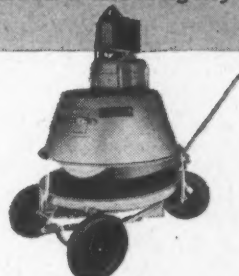


## THE MULBARO

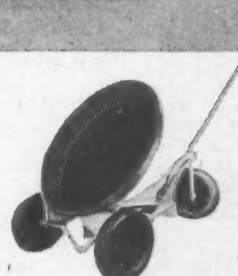
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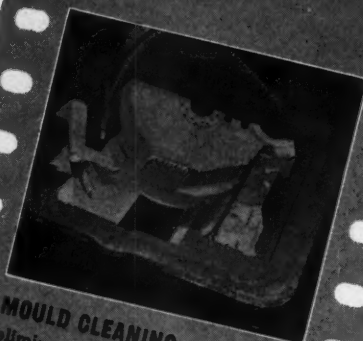
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Steel  
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4. Pictures, charts and diagrams.
5. Discussions which took place when the papers were presented.

**AMERICAN FOUNDRYMEN'S ASSOCIATION**

222 West Adams Street

--

Chicago 6, Illinois

## Convention

(Continued from Page 89)

to the foundrymen attending this 51st Annual Meeting: F. J. Walls, International Nickel Co., and past President of A.F.A. will serve as *Honorary Chairman* of the general committee, and Mr. Allen as *General Chairman*. Other members of the general committee include C. E. Silver, Michigan Steel Casting Co., *Vice-Chairman*; W. W. Bowring, Frederic B. Stevens, Inc., *Treasurer*; R. E. Cleland, Eastern Clay Products, Inc., *Secretary*, all of whom occupy parallel capacities as Detroit chapter officers, and C. L. Gorney, *Assistant Secretary*.

Steps are being taken to obtain the attendance of members of nearby A.F.A. chapters, and all educational institutions in Detroit and Michigan, through appointment of a special committee on regional attendance. *Chairman* of this committee is C. C. Sigerfoos, Michigan State College, Lansing, Mich., and the chairman of the Saginaw Valley, Western Michigan, Toledo and Michiana chapters have been asked to serve as committee members, respectively, J. F. Smith, Chevrolet Grey Iron Foundry Div., General Motors Corp., Saginaw, Mich.; Rudolph Flora, Clover Foundry Co., Muskegon, Mich.; B. L. Pickett, Unitcast Corp., Toledo, Ohio; and John McAntee, Covell Mfg. Co., Benton Harbor, Mich.

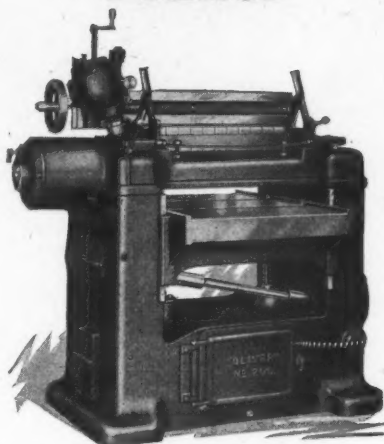
Committees of the host Chapter, thus far appointed, include a Plant Visitation Committee, Banquet Committee, Reception Committee, Shop Course Promotion Committee, Finance Committee, Publicity Committee, and "Ford Day" Committee. The latter group is laying plans for special plant visitations to the Ford Motor Co. Foundry on Friday, May 2, following the close of the convention. It is expected that a considerable number of visiting foundrymen may desire to stay over for this interesting visitation.

The Shop Course Promotion Committee has been appointed to increase the attendance of local plant men at the Gray Iron and Sand Shop courses held during convention week. As a result, it is expected

(Continued on Page 91)

AMERICAN FOUNDRYMAN

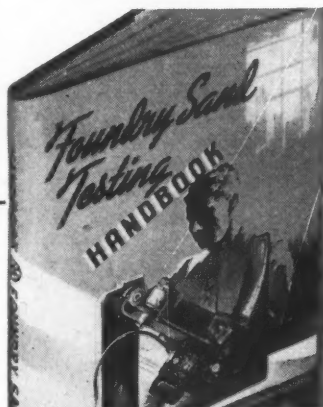
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that these popular "off-the-record" sessions will be even better attended than in some former years.

Following this article is a list of convention committee members thus far appointed:

### Plant Visitation Committee

- H. M. Bringham, Semet-Solvay Co., *Chairman*  
J. E. Linabury, General Motors Corp., *Vice-Chairman*  
E. A. Petersen, Dodge Manufacturing Co.  
J. Edw. Coon, Packard Motor Car Co.  
W. O. Leonard, Wilson Foundry & Machine Co.  
M. L. Gardner, Detroit Gray Iron Foundry Co.  
J. Martin Duncan, Detroit Steel Casting Co.  
E. D. Flintermann, Michigan Steel Casting Co.  
N. N. Olson, Swedish Crucible Steel Co.  
L. H. Middleditch, Central Foundry Co.  
F. R. Mason, Riley Stoker Corp.  
Don Christian, Acme Foundry Co.  
J. L. Mahon, American Car & Foundry Co.  
L. G. Korte, Atlas Foundry Co.  
O. E. Sundstedt, General Fdry. & Mfg. Co.  
H. B. Updegraff, Aluminum Co. of America  
A. G. Baker, Michigan Malleable Iron Co.  
P. J. Potter, Federal-Mogul Corp.  
H. J. Mittelstadt, Hanna Furnace Div., Great Lakes Steel Corp.  
N. D. Devlin, Rotary Electric Steel Co.  
O. L. Allen, Pontiac Motor Div., General Motors Corp.

### Publicity Committee

- C. E. Silver, Michigan Steel Casting Co., *Chairman*  
W. N. Seese, J. S. McCormick Co.  
W. G. Patton, Climax Molybdenum Co.  
C. J. Ritinger, American Car & Foundry Co.  
J. P. Mullen, A.F.A. National Office  
R. E. Cleland, Eastern Clay Products, Inc.

### General Committee

- F. J. Walls, International Nickel Co., *Honorary Chairman*  
(Continued on Page 93)

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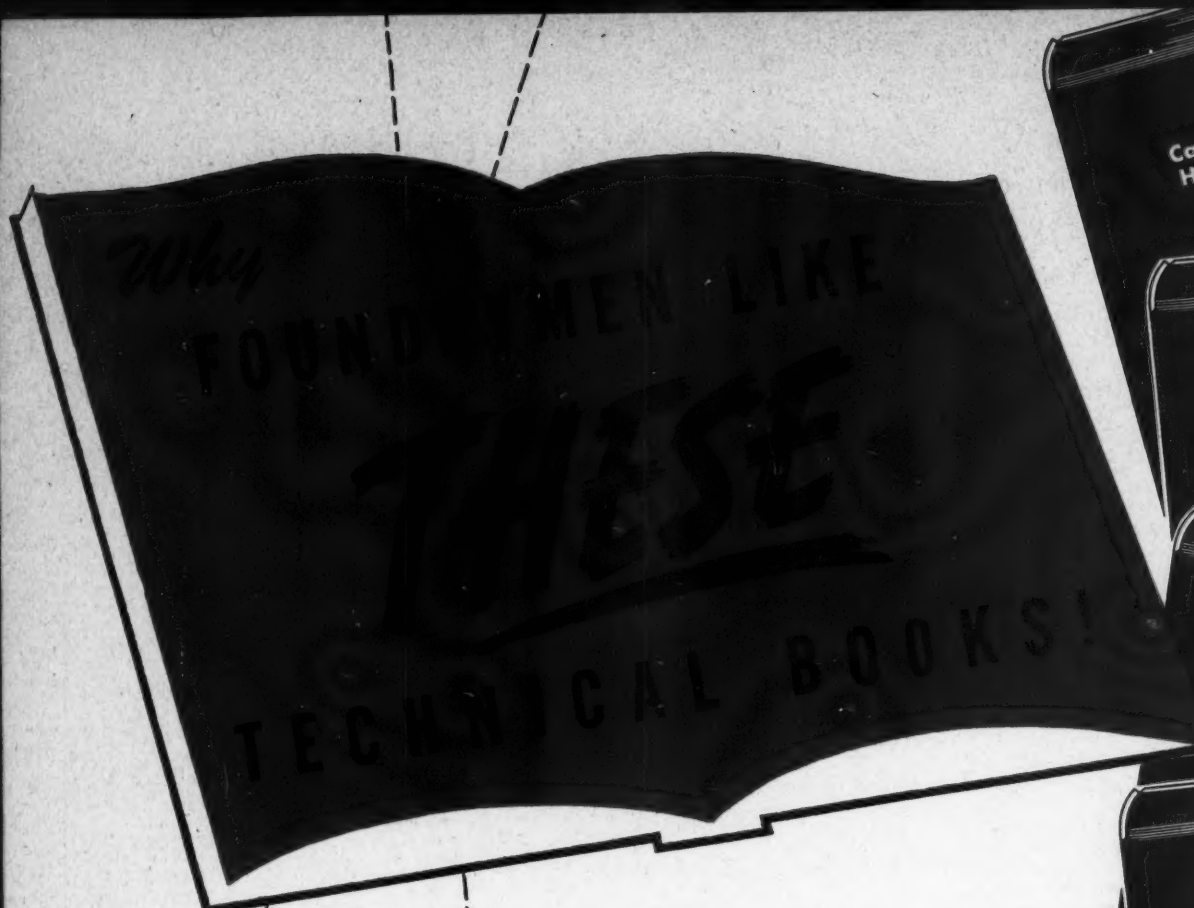
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549 West Washington Boulevard  
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Attention: Mr. W. E. Illig

Gentlemen:

During the delivery of the Simpson Mixer to your plant, we were informed that you were having trouble with the sand conditioning system. We are pleased to hear that the Simpson Mixer is now working properly and that you are able to make these minor repairs without interruptions in our molding operations.

Thank you for your letter of August 18th, 1944, regarding the Simpson Mixer. We are pleased to hear that the Simpson Mixer is now working properly and that you are able to make these minor repairs without interruptions in our molding operations.

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—says Banner Iron Works, referring to the sand conditioning system they designed, built and installed in 1943, under the very able direction of Mr. W. E. Illig.

The accompanying letter is indicative of the way in which Simpson Mixers are meeting foundry demands for a greater production of better quality molding and core sands... day after day, year after year.

This evidence of superior performance is not an isolated case. On-the-job reports in foundries both large and small prove that Simpson Mixer installations are constantly producing foundry sand better, faster and at less cost.

Ask a National Engineer to discuss the details with you.

facing sands pass through this system daily.

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Yours very truly,

BANNER IRON WORKS

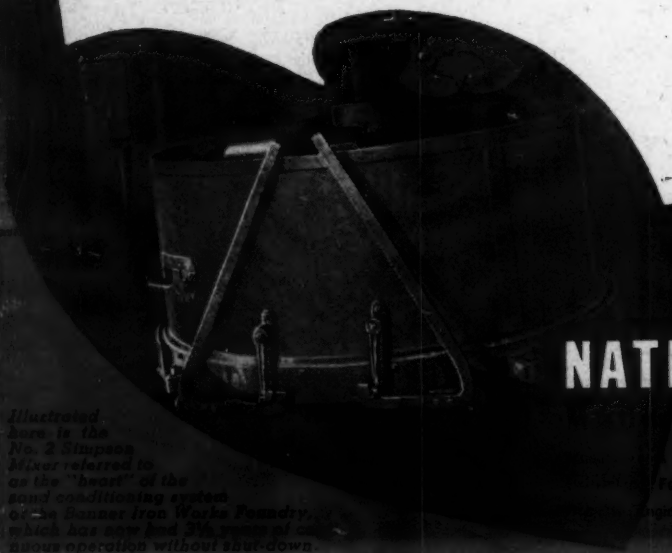
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Illustrated here is the No. 3 Simpson Mixer referred to as the "heart" of the sand conditioning system at the Banner Iron Works Foundry, which has now had 3½ years of continuous operation without shut-down.



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